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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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TRAIN COLLECTORS AND TRAIN AUDITORS.

The only difference between a train collector and a train "auditor" appears to be that the collector is a regular and constant employee on the train to which he is assigned, while the "auditor" is an occasional collector. Inview of the recent employment of "auditors" on a number of large western roads it is of interest to note this difference. In his first trip on a given train the work of the auditor is "surprise checking," but not exactly "spotting." Collectors have been employed at various times on a considerable number of roads, but after a short time—from six months to two years—have been taken off. The Pennsylvania had collectors 30 years ago, but appears to have thoroughly satisfied itself very soon, for they were taken off and the road has had none since. The Rock Island, the Chicago & Alton, the Missouri Pacific, the Missouri, Kansas & Texas, the Wabash, and the Burlington are all now trying the auditor scheme. The Wabash formerly had collectors. These were all dismissed when Mr. Delano took charge of the road, about a year ago, but it is reported that auditors are now employed on that road. The auditor, armed with proper authority from the general manager, boards a train at any time and any place, without previous notice to the conductor. Just as a traveling auditor comes into a freight office and takes possession of the books and cash drawer as though he owned them, the train auditor takes the conductor's work out of his hands completely, so far as concerns the collection of tickets and fares.

The somewhat rapid spread of the auditor idea would seem to indicate that satisfactory results are secured. It is, of course, absurd to assert that the auditor is put on because the conductor of the train needs all of his time for other duties. If this were true, the only consistent arrangement would be to have the auditor on each important train every day. Again, the duties of the conductors on some trains are very much lighter than on others, and the need of relieving them is correspondingly less pressing; yet we find that train auditors are sent to "work" trains on some of the easiest runs. While the work of the train auditor outwardly resembles that of the auditor of station accounts, as has been suggested, it must be borne in mind that there is nevertheless a radical difference. The auditing of the station accounts is to test the accuracy or honesty of the work of the station agent for a term of weeks or months preceding; but the work of the conductor for every day previous to that on which he is "audited" has been settled beyond recall. Any errors or frauds committed in the past are incurable. This being so, the purpose in employing the train auditor is, manifestly, (1) to find out, if possible, how a conductor does his work; this by having the same kind of work done by some one else. (2) To keep conductors keyed up to a high degree of faithfulness and efficiency by the knowledge that at any moment an inspector may appear to look for flaws in their work.

As is the case where "spotters" are employed under the old methods, there is no need for a conductor to feel that the action of the company reflects on his honor. Surprise checking is sufficiently justified by the need of correcting careless habits. If a conductor fails to collect a fare, the attitude and the function of the auditor who discovers the failure is the same, whether it was due to carelessness and inefficiency or to the fact that the conductor had secretly received money from the passenger and was paying back the "gift" by giving him a ride at the expense of the company.

On one of the Chicago roads on which train auditors have lately been put in service the men employed are quite young and some of them have had little or no railroad experience. Indeed, the instructions to the conductors and to the auditors recognize this, fully. The conductor is not made into a sort of freight conductor, where he can ride in the engine half the time if he sees fit; he continues to have oversight of the passengers, and assists the train auditor, if so requested, in cases where, by reason of crowds, passengers might leave the train before their tickets had been taken. In case an auditor has any dispute with a passenger he must turn the case over to the conductor, and the conductor decides it wholly according to his own judgment. Train auditors do not take any part in the management of the train or the work of the members of the train crew, except in cases of emergency, when the train conductor may call on them.

It seems probable that the train-auditor scheme will prove permanently useful, if care is taken to employ competent men—which does not appear to be the case on all of the roads where the experiment is now being tried. There is no hope of making dishonest conductors honest by machinery; but our method of collecting fares would still be extremely unbusinesslike and in need of safeguarding if every conductor in the country were the perfection of honesty. "Jacking up" will therefore be a perpetual necessity unless we radically change the methods. Only by the use of a cash-register can a grocer keep his own methods correct and efficient, to say nothing of his hired clerks. In like manner a dozen honest conductors

who owned a railroad would owe it to themselves to have a man to discipline them and nip in the bud every slipshod habit. Irregular collectors will cost materially less than to regularly assign one to each train for every trip, for the expectation of being inspected has, with honest men, almost as good an effect as actual inspection. To detect and discharge the dishonest conductor is a problem requiring particular and independent attention. The manager who sets out to do this will realize, of course, that "auditing" and "spotting" are only preliminary measures, after all. They may serve, like a grand jury, to show "probable cause"; but to settle a case in a way to warrant decisive action, more elaborate procedures are, of course, necessary.

INTERNAL COMBUSTION ENGINES FOR SHOP POWER.

The description of a combustion engine published in another column is interesting as indicating the trend that the development of power has taken within the past two decades. The internal combustion engine has been brought to a high degree of perfection in the small sizes, such as are used for motor boats and automobiles, but their liability to at least temporary failure under these working conditions has caused them to be regarded with suspicion by those who are responsible for the selection of a motor for a large plant where reliability is of the first importance, outranking even that of efficiency.

That there has been a reason for this suspicion there is no doubt, but recent experiences and investigations have gone to prove that the internal combustion engine has reached a stage in its development when it can be regarded as quite as reliable as the steam engine, while its economical utilization of the heat developed is well in the lead.

The advantages are the entire absence of that never-failing source of danger—the steam boiler, the possibility of operation without constant skilled attention, and the more economical use of the heat developed.

Of the two, the getting rid of the boiler and constant attention, nothing need be said. As to the economical use of the heat, while this may be readily granted, the actual economy arising from the use of the internal combustion engine depends upon the initial cost of producing the heat. Where oil or gas is very cheap and coal expensive, then the cost of operation will be in favor of the oil or gas engine. But as the price of coal drops and that of oil or gas rises a point is reached where the two are on a par and beyond which the steam engine will be the cheaper of the two. The question of selection, on the basis of economy of operation only is, therefore, a local one which each user must answer for himself.

Recent investigations by the Baldwin Locomotive Works have led them to decide to use a large number of internal combustion engines, probably the Hornsby-Akroyd, which is very reliable, and nearly as efficient as the Diesel. They are especially suited for power development in limited spaces and where the use of steam is dangerous. Further than this, the handling of coal in the heart of Philadelphia has had an important bearing on the decision. In the several shops that are crowded with workmen the bursting of even a single steam fitting would be dangerous to life as well as property, so that there is a considerable mental tension imposed on those who are responsible, especially while the works are in operation for 24 hours of the day.

This desire to secure a reliable and less dangerous means of providing the necessary power in the plant has led to the decision to use nothing but internal combustion engines in the new Baldwin plant that is being erected at Eddystone.

Aside from increased safety, there is decreased cost of operation. It is estimated that instead of obtaining 65 per cent. of the efficiency of the engine at the shafting, as in the case of the steam engine driving a dynamo and, with the current driving a motor, an efficiency of 90 per cent. of the internal combustion engine output will be obtained by coupling direct to the shafting.

On this basis, if it is assumed that the steam engine will utilize 12 per cent. of the heat of the fuel and the internal combustion engine no more than 30 per cent., it would even be possible to pay three and a half times as much per 1,000 heat units for the internal combustion as for the steam engine and still have the cost of operation of the two on a par.

As a matter of fact, the Baldwin tests in service sustain the accuracy of this inference. Rating coal at $3 per ton and crude oil at 1.99 cents per gallon, it has been found that the total cost per brake horse-power hour at the engine shaft is .786 cents for the steam engine, .436 cents for the Hornsby-Akroyd engine and .42 cents for the Diesel. A compound condensing steam engine was used in making this comparison, and its boiler evaporated 8.05 lbs. of water per pound of coal. These tests also showed an oil consumption of 11.3 gallons per 100 brake horse-power hours for the Hornsby-Akroyd engine and about 7.2 gallons for the Diesel, the lesser difference in the total cost of operation as noted above being made up of other items not enumerated. In this the specific gravity of the oil is .908, so that a gallon weighed about 7.57 lbs.

In the matter of closeness of regulation it was found that there was a variation of but 1.74 per cent. in the rate of rotation of the fly-wheel of the Hornsby-Akroyd engine, which brings it within the allowable variations for the driving of electrical machinery.

These facts are cited to indicate what can be done in the way of efficiency and a saving in power-plant operation, and that the use of this type of engine is now so well advanced that it has passed beyond the experimental stage, so that when safety and reliability are the requisites it will be found to fulfill the requirements, while the cost of operation depends on the relative prices of coal and oil that prevail at the point of application. The matter should, therefore, be of especial interest to railroad men especially in such districts as Texas or California, where crude oil can be purchased in abundance at a low price.

That the wide introduction of this type of engine would serve to enhance the cost of oil is probably true, when viewed from the standpoint of the increasing cost of gasolene under the demands for automobile work, just as it was estimated a few years ago, that should the Pennsylvania Railroad adopt oil as a locomotive fuel on all of its engines it would have required the total supply of the United States at that time—a condition that would have made the cost prohibitive.

There is little prospect, however, that there will be such a demand on the part of stationary engine users, so that the adoption of the internal combustion engine need not be influenced by any such fears.

THE EXPRESS COMPANIES.

The organization and operations of the express companies are at the present moment attracting considerable attention. One of the reasons for this is that, by a readjustment which seems probable, the Adams Express Company will lose nearly one-third of its present mileage to a new company called the Northern Express Company. It is probable that this company, organized as the successor of the Northern Pacific Express, is to consolidate the Great Northern Express and the Northern Pacific Express, which now operate each over the road named in its title, and on the expiration shortly of the Adams Express Company's contract with the Chicago, Burlington & Quincy, to add to its mileage that 8,500 mile system, thus consolidating the express business on all of the Hill lines. More important than this in its effect on the express business, determined effort is being made by a considerable proportion of the stockholders of the Wells-Fargo Express Company, another of the four leading companies, to obtain larger dividends. Their contention is that the company is earning at least 30 per cent. a year and can conservatively afford to distribute 16 per cent. in dividends. This movement has already been successful in securing an increase of the dividend rate from 8 to 10 per cent. and the publication of some slight information about the financial condition of the company. A similar movement has been contemplated by stockholders of the United States Express Company, which now pays 4 per cent. dividends, and is alleged to earn at least 18 per cent. on its stock. By far the most important of the causes directing attention to the express companies is the fact that they have been brought under the operation of the new Interstate Commerce law.

The *Wall Street Journal* in a sketch of the four express companies which it is estimated do about 90 per cent. of the express business of the country—the Adams, the American, the United States and the Wells-Fargo—shows that the combined mileage of railroad over which they work is 158,000 miles, and that their combined capital is $48,000,000. The Adams, the American and the United States are joint stock companies. The Wells-Fargo is incorporated in Colorado. These four large companies appear to be in very friendly relations one to another. L. C. Weir, President of the Adams Express, and J. C. Fargo, President of the American, are directors in the United States Express Company. Also nearly one-half of the directors of the four companies are railroad directors. Of the 13 Wells-Fargo directors, eight are officers or directors of railroads; of the nine American, three are railroad directors; of the seven Adams, and of the seven United States, three each are railroad

directors. In addition to this inter-relation of control, two of the three smaller companies are openly or practically controlled by the larger group. The American Express Company closely controls the National, which has $5,000,000 capital, and operates over 7,000 miles of road, and the Adams controls the Southern Express Company, which has about the same capitalization and operates a mileage of about 32,000 miles. The Pacific Express, the third of the smaller companies, has a mileage of 22,000, and operates largely west of the Mississippi, its principal railroads being the Union Pacific and the Missouri Pacific. Its board of directors contains four Gould and two Harriman representatives. The mileage of the four most important companies is as follows: Adams, 29,000 miles; United States, 30,000 miles; American, 43,000 miles; Wells-Fargo, 56,000 miles.

The express companies of the United States make no reports of their operations. The only clue to their gross business lies in figures published by the Interstate Commerce Commission showing the amounts received by the railroads from the express companies, which are, roughly, about 50 per cent. of the gross earnings of the express companies. The railroads' income from the express companies has increased from $28,000,000, in 1900, to $41,000,000, in 1904. During this five years the railroads of the country increased their earning capacity 33 per cent., and at the same time enlarged their capitalization by 15 per cent. Basing the estimate on the payments to the railroads, the business of the express companies increased 47 per cent., with no increase of capital. Besides these payments of 50 per cent. to the railroads, operating expenses probably require another 40 per cent. of gross earnings, leaving 10 per cent. as the net earnings to the express companies. On this basis the net earnings of the express companies have increased from $5,000,000, in 1900, to $7,500,000, in 1904. Thus although no definite figures are obtainable, it is abundantly evident that the express business of the country is highly profitable.

The whole question of larger disbursements to stockholders appears to be bound up in the question of publicity for express company accounts. At present no returns whatever are made and the stockholders are left to conjecture as to the real earnings of their companies. This is the dangerous feature in express company management as it exists to-day. Leaving out of consideration the question of a parcels post operated by the government which, if the example of similar service abroad is any precedent, could carry a large part of the express business at a much lower rate, the time has passed when so important a public business should be conducted so secretly. Not only the stockholders of the express companies, but those of the railroads, have the right to know under exactly what arrangements this highest grade traffic is being carried on. On the expiration of a contract with an express company the stockholders of the railroad should be informed of the conditions and have a chance to form an intelligent opinion as to whether it is to the advantage of the railroad to continue the contract, and if so, on what terms. The present day agitation against corporations has been largely caused by secrecy such as this in regard to matters vital to the financial interests of stockholders—a condition always likely to result in manipulation by an inside ring—and it seems reasonable to expect that the veil of mystery hitherto surrounding the express business will soon be drawn aside. The Interstate Commerce Commission will no doubt now require the express companies to make full reports of their business and of the arrangements under which it is done. Such statements will make clear the whole question of whether larger dividends should be paid, and, from the railroad standpoint, of whether the present express contracts are equitable.

The following table gives the most important railroads over which the principal express companies operate. In cases where more than one company operates over a road the most important company is mentioned.

Wells-Fargo Express Company.

Atchison, Topeka & Santa Fe System	El Paso & Southwestern System
Southern Pacific System	Kansas City Southern
Chicago, Rock Island & Pacific	Mexican Central
St. Louis & San Francisco	Mexican International
Erie	San Antonio & Aransas Pass
Chicago Great Western	Vera Cruz & Pacific
Denver & Rio Grande System	Tehuantepec National.
Colorado & Southern	

American Express Company.

New York Central Lines*	Missouri, Kansas & Texas
Chicago & North-Western System	Central Vermont
Illinois Central System	Chicago, Indianapolis & Louisville
Boston & Maine System	Buffalo, Rochester & Pittsburg
	Bangor & Aroostook.

*Except Lake Erie & Western.

United States Express Company.

Chicago, Milwaukee & St. Paul	Chicago & Alton
Philadelphia & Reading System	Delaware, Lackawanna & Western
Baltimore & Ohio System	Lehigh Valley
Cincinnati, Hamilton & Dayton and Pere Marquette	Ohio Central Lines
	Lake Erie & Western.

Adams Express Company.

Pennsylvania Lines	Chesapeake & Ohio
New York, New Haven & Hartford	Richmond, Fredericksburg & Potomac
Chicago, Burlington & Quincy	Western Maryland
Iowa Central and Minneapolis & St. Louis	Kansas City, Mexico & Orient.

Southern Express Company.

Operates over all important railroads in southern territory, including the Norfolk & Western. Adams Express also operates over Louisville & Nashville.

Pacific Express Company.

Union Pacific	International & Great Northern
Missouri Pacific	Texas & Pacific
Wabash System	Texas Central
St. Louis Southwestern	Detroit, Toledo & Ironton System

National Express Company.

Delaware & Hudson	Toledo, St. Louis & Western
New York, Chicago & St. Louis	Wisconsin Central.

Also operates jointly with the American over several railroads.

BLOCK SIGNALS FOR FAST AND FREQUENT TRAINS

The diagram for use in adjusting block-signal sections to the speed and frequency of trains, which an anonymous correspondent offers on another page, tempts the reader to apply it to a concrete example; and as it seems to be adapted to an example with which we are familiar—the New York Central at its New York City end—we have so applied it. Indeed, as the diagram assumes the use of an overlap the length of a block we guess that it was made by and borrowed from the New York Central. The first conclusion one reaches is that the New York Central had better prepare to run 15-car or 20-car trains. If it does not its line will soon be overtaxed with trains during the busy hours of the morning. The maximum length of block sections on the electrified zone is to be about 3,250 ft., we believe; and with this length trains running a mile a minute must be kept a fraction over two minutes apart. Even now it is found desirable every day to run trains at shorter intervals than that.

When two suburban divisions converge into one, as is the case at Mott Haven, five miles out from the Grand Central station, the limit of the capacity of a railroad quickly shows itself. The passenger department must of necessity strive to please the clamoring commuters on both divisions by running trains every five minutes at each station—which means perhaps every three minutes, two minutes or one minute when *all* the trains on the line are counted; but to the operating officer the shortness of the trains, when looked at in connection with the great length of the blocks seems extravagantly wasteful. He feels like asking the P. T. M. and the G. P. A. to let their kindness of disposition work a bit within the family once in a while. With 3,240-ft. blocks, multiplied by three, and trains 520 ft. long, only one-twentieth of the track is occupied by cars—a condition that must invite scornful comments on railroad economy from the moving-platform enthusiasts.

It seems to us that our correspondent has figured his time interval rather too short. To run trains at high speed enginemen ought to be allowed, say, ten seconds in which to see a clear signal before reaching it; otherwise they will be constantly tempted to run too close and take risks. The computation should be:

Block	3,240 ft.
Distant	3,240 "
Overlap	3,240 "
Train	520 "
Time to clear signal, 4 seconds x 88	352 "
Time to see signal, 10 seconds x 88	880 "
Total	11,472 ft.

Or, 2.17 miles. This is an increase of 8½ per cent.; or a reduction in the capacity of the road of 7.8 per cent. By lengthening the train to twice 520 ft. we make the total 11,992 ft. We increase the demand on the time of the track only 4½ per cent. and (with that deduction) increase the capacity of the line 100 per cent. if the whole train is made up of cars, as in electric practice. The New York Central standard electric car is 60 ft. long over all, making 1,020 ft. for a 17-car train.

Our correspondent holds that as a regular thing good practice demands that a distant-signal indication should not be repeated; should not be given any farther back than the next home signal. As speeds and frequency increase there must be more and more cases where this desirable element of simplicity will have to be given up. For example—to again take this concrete instance near home—the outer tracks for 25 miles north of New York City will be used for local passenger trains and should have many short blocks. Each station must be in a short block, so that the length of time spent by a train in the station block shall not be disproportionately long as compared with that spent in the blocks where there are no stations. This means perhaps 1,600 ft. blocks, say half the New

York Central maximum. But with the heavy through passenger business of this line occasions must be frequent when this outer track is needed for express trains. These trains often become "bunched" together when behind time, and it is not always convenient to drive the through freight trains off from the inner tracks. Also, many semi-express trains often have occasion to run on the outer tracks without stopping, and therefore need to have facilities for running at high speed. In view of these conditions, it is desirable to signal the outer tracks for express speeds—say, sixty miles an hour; and with short blocks this cannot be done unless the distant signals are set back two or three blocks.

And, with suitable instruction and discipline, this would seem to be wholly unobjectionable, so far as the engineman is concerned. The distant signal has fared pretty hardly in America. It has been kicked, neglected and abused in a way entirely at variance with its usefulness and importance, and it is high time that we relieve it from the humiliation of always being made secondary to everything else!

Restricted Accounts and Memoranda.

A feature of the Hepburn law that may or may not cause much embarrassment and expense to the railroads—depending upon the manner in which it is enforced by the Interstate Commerce Commission—is the provision empowering the Commission, in its discretion, to prescribe the forms of any and all accounts, records and memoranda to be kept by carriers, including the accounts, records and memoranda of the movement of traffic as well as the receipts and expenditures of moneys, and making it unlawful for carriers to keep any other accounts, records or memoranda than those prescribed or approved by the Commission. The law provides that the Commission shall at all times have access to all such documents kept by carriers, and that it may employ special agents or examiners to inspect and examine the papers. A strict interpretation of this provision would seem to require all railroads to have their present forms of accounts, records and memoranda approved by the Commission on or before August 29, the date when the law becomes effective, whether the Commission is prepared by that time to prescribe uniform forms or not. It is not probable, however, that the Commission will require this. Its employees are now working on a scheme of uniform records to be submitted to the Commission, and it is probable that before any orders are issued for putting this scheme into effect it will be submitted to practical railroad men for their criticism and suggestions.

The power to prescribe uniform statistical reports and uniformity in the keeping of accounts, records and memoranda is one that the Commissioners have contended for very zealously. A recent magazine article by Commissioner Prouty indicates that they hope to accomplish two things through the exercise of this power. They hope that it will enable them to trace and detect departures from the published rates and rebates and discriminations of all kinds. They also believe that it will enable them to determine with more certainty whether railroad rates that may be called into question are such as are required to yield a fair return on the property. Many of the reports and opinions of the Interstate Commerce Commission have shown that its members regard with disapproval the policy of those roads that make a practice of charging improvements to operating expenses, and it may be expected that any uniform system prescribed by the Commission will attempt to provide for a distinct separation between operating expenses and improvements. It is evident, however, that great difficulty will be experienced in drawing a sharp and distinct dividing line between expenditures for maintenance and those for betterments. In a case, for instance, where light rails are being replaced with heavy ones, part of the expenditure might properly be apportioned to maintenance and part to improvements, and it will be interesting to see how the Commission deals with such expenditures.

The law gives to the Commission very wide discretion, and there can be no doubt that, as was pointed out in the Senate when this provision was under discussion, it might be so enforced by the Commission as to subject to punishment every railroad official and employee who might make any note or memorandum whatsoever concerning the railroad or its operation if the form of such note or memorandum had not been first approved by the Commission. It is hardly to be expected that the Commissioners will go to such extremes in the exercise of the discretion given them. They can hardly conceive it necessary to go further than to prescribe the forms of such accounts, records and memoranda as are necessary for the disclosure of all the operations of the road, leaving its officers and employees free to use such additional records and memoranda as may from time to time be necessary.

One of the most serious dangers is that the enforcement of this provision will tend to prevent improvements in railroad accounting and in the records of railroad operations. When a system has once been prescribed by the Commission no improvement, however great it may be, can be adopted until it has been approved by the Commission. What one road might consider an improvement might meet the approval of the Commission, and might be prescribed for all roads, though others might not consider it an improvement in any respect. The conditions on different lines vary so greatly that a system suitable for one line may not be entirely suitable for another. It will doubtless be within the power of the Commission to permit more or less diversity on different railroad lines, but the tendency in the direction of prescribing absolute uniformity seems to be so strong that there is little probability that much diversity will be permitted.

June Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of June, printed in another column, contains accounts of 28 collisions, 26 derailments, and two other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Place.	June	Killed.	Injured.
1.	Marion, N. J.	2d	0	1
2.	Atlanta, Ga.	6th	1	6
3.	Mengo, Mo.	8th	1	22
4.	Eatontown, N. J.	11th	1	23
5.	Marine, Ia.	14th	0	11
6.	Adrian, Mich.	25th	0	9
7.	Gladbrook, Iowa.	25th	0	6
8.	Jamestown, Cal.	27th	2	2
9.	Martin, Fla.	29th	2	0
10.	Ipawa, Ill.	30th	1	3

The two most conspicuous accidents in this list are, perhaps, the first and the fourth. They happened to passenger trains which run at high speed and carry important traffic; they occurred on important lines, near the largest city in America—lines managed by enterprising officers, not pinched for money—and yet they will be universally classed as due to the lack of well-known safety devices which are generally approved and not very costly. The primary cause was in the one case carelessness of a drawbridge tender who neglected to see that all trains were held back before he opened the draw, and in the other case negligence of a trainman who did not reset a switch after using it. But everybody will look at the secondary causes; the absence of mechanical safeguards against these kinds of carelessness. That carefulness which insures safe drawbridges and switches is a matter of habit, and the management of a railroad is responsible for providing the groove in which draw-tenders' and trainmen's habits shall run. This draw-tender appears to have allowed the passenger train to approach within a third of a mile under clear signals and then to have suddenly changed the signal to indicate stop. If he had changed the signal in the face of the engineman, it would have been gross misconduct, for the train had received a clear distant signal which was a warrant of a clear home signal; but he did worse than that; he changed the home signal *after* the engine had passed it. With an electric lock on the drawbridge controlled (kept locked) by the presence of the train on the track, this error would have been prevented. Such locks are so arranged that they can be unlocked only when the approach track is free of trains back as far as the distant signal, and a little farther. In this case the home signal would seem to be located unnecessarily remote and the distant signal much too remote. The bridge tender has far too much time in which to change his mind. With the signals nearer the bridge he would have been much less likely to make this blunder, even if not restrained by an electric lock.

The proper mental groove for the habits of a freight train man who has to turn switches is very hard to maintain. Railroad superintendents have been trying for 80 years to hit upon the best rule but have not yet found one which is workable and perfect. They have, however, found an antidote for the dangers connected with an imperfect rule, and that is the interlocked distant signal. This simple device, costing from $75 to $250, compels the switch tender either to leave the switch in the right position, when he goes away, or to display, a half mile away, a warning that it is not in the right position.

In printing simple homilies like this, which we have been doing for the past 30 years, a query always arises as to the reasons why some of our good railroad managers do, and some other good managers do not, use well-known safeguards at well-known danger spots. To answer this question is as difficult as ever, speaking generally. But concerning one railroad system, embracing 10,942 miles, we can quote from a letter from the manager dated July 3, 1906, as follows:

"It is our intention to instal electric distant signals for all facing points on main lines.

"We intend to instal mechanical distant signals for all facing points on branch lines."

As the lines referred to are largely single track, these statements might almost as well read "all switches," as all are facing points.

The number of electric car accidents reported in the news-

papers of the United States in the month of June was 24, in which 16 persons were killed and 247 injured. Of the killed 11 and of the injured 75 are chargeable to the derailment of a runaway car near Providence, R. I., on the 3d. This accident occurred to an excursion party about 1 o'clock in the morning, and it appears to have been due to the unfamiliarity of the motorman with the line. He had not run on that line since about one year before and even then his experience was confined to a single trip.

CONTRIBUTIONS

Block Signaling for a Maximum Traffic.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The problem of signaling a road for the running of the greatest possible number of trains has not often presented itself for solution. The time is fast approaching, if it is not already here, when the problem will have to be solved by many signal engineers. A number of the large terminals are signaled for a heavy traffic, and possibly for a maximum train service, but in a majority of cases the speeds are moderate, and the end most generally sought has been to make the blocks of equal length, while giving a good view of the signals.

The conditions that determine the length of the block and consequently the number of trains that may be run in a given time are:

1. The speed.
2. The braking power and consequent distance required in which to stop a train running at maximum speed.
3. The grade of the track.

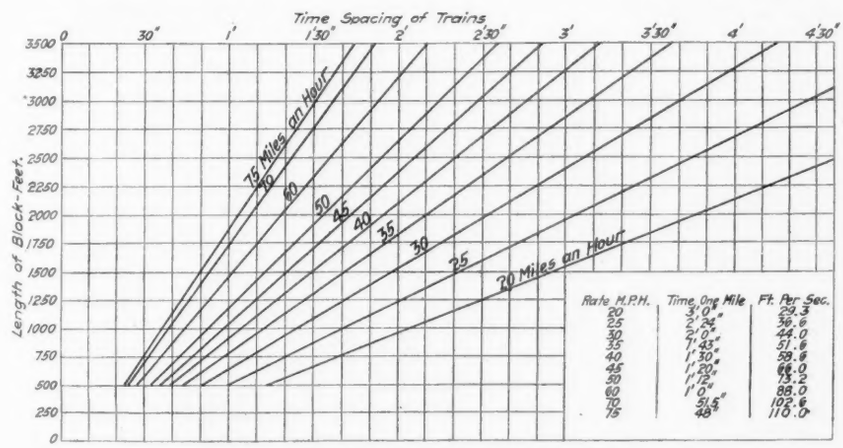


Chart for Time-Spacing Block-Signaled Trains.

4. The time required for the signals to change from the position indicating "Stop" to that indicating "Proceed."
5. The length of the train.
6. The position of interlocking plants, stations and other local conditions which cause an irregular spacing of the signals.

The number of trains that may be run in a given time is, of course, dependent on the speed. The greater the speed the greater the number of trains that may be run. To provide for a maximum train service it must be possible to run trains at the greatest speed local conditions permit, and the blocks must be of such length as to allow this speed to be attained with safety.

To run a train safely at a given speed it is necessary to keep the engineman informed, at all times, of the conditions of the track in front of him and if it is proper for the train to proceed. If it is not safe to proceed the engineman must be warned at a point sufficiently far away from the stopping point to enable him to bring the train to a stop before passing it. The higher the speed the greater the distance from the stopping point the indication to stop or to proceed must be given. To give the indication at a less distance away than is required for the train to be brought to a stop is inviting disaster.

The distant indication is given by the distant signal, and it is therefore necessary that this signal be placed far enough from the home signal to enable a train to be brought to a stop in the distance between the two signals. The braking power then becomes as important an element in determining the length of the block for a maximum train service under safe working conditions as are the factors of speed and grade. With good practice demanding that, as a regular thing, the indication of a home signal shall be repeated by one and not by two distant signals, it follows that for the average conditions the distance between the distant and the home signal is the length of the shortest block that may be used with safety.

The speed of a train is affected by gravity assisting or retarding its motion according to the grade of the track. Any power affecting the speed of the train will have a corresponding effect on the braking power, and the length of the block must therefore be proportioned to the grade.

The length of time required for a signal to change from the stop to the proceed position has an important bearing on the efficiency of a signal system and the consequent spacing of trains. The time required for a signal to assume the clear position is only a few seconds; but, as the home signal does not commence to clear until the train has passed out of the block, the next following train is delayed, while the home and the distant signals are clearing. The practical result is the same as if the block had been lengthened the distance the train will run in the time the two signals are clearing. A maximum train service requires a minimum time for the clearing of the signals. A change from one second to five seconds in the time required to clear a signal—lengthening the time four seconds—will reduce by 10 per cent. the number of trains it is possible to run when the speed is 60 miles an hour and the length of block equal to the braking distance.

The length of a train will affect the number it is possible to run in a given time, for the signals do not commence to clear until the rear of the train has passed out of the block; the train must run its length, in addition to the length of the block, before the signals will clear for the following train. Trains running at speed are spaced the length of the train, plus the length of the block, plus the distance between the distant and the home signals, for with the short blocks necessary for a maximum train movement the application of the brakes at the distant signal, as will be necessary if the signal, when passed, is indicating caution, will reduce the speed so materially that trains will be spaced a greater distance than if they were run far enough apart to get a clear indication at each distant signal.

The position of interlocking plants, stations and similar local conditions, the situation of which is fixed and cannot be changed to permit of the best placing of signals, will affect somewhat the time-spacing of trains. Where the interlocking and station signals occur at such intervals that the blocks are of equal length, the regular spacing of trains can be maintained, but where the blocks are of unequal length trains will be kept further apart and the situation must be carefully studied. At those places where the blocks will be shorter than the required distances between the distant and the home signal the indication of the home signal must be repeated by two distant signals, and the furthest of the two is likely to be found a greater distance from the home signal than the necessary braking distance, thus giving an indication so far away that the train may be stopped some time before reaching the home signal.

Having the information at hand in regard to layout of tracks, grades, curvature, station locations, etc., it is necessary before the signals can be located on the plan that an assumption be made as to the maximum speeds which trains will be allowed to attain on the different parts of the line. The chart shown in the accompanying cut, giving the time spacing of trains for various lengths of blocks and speeds is convenient for reference when comparing one arrangement of signals with another and when consulting with the officials of the operating department in regard to permissible speeds and the probable time intervals between trains. This chart shows, in minutes and seconds, at the top of the diagram, the necessary time interval between trains at various speeds, with block signals fixed at different distances apart, as shown at the left of the diagram. The length of a train is assumed to be 520 ft., and provision is made for having at all times two home signals in the stop position behind a train. Therefore, to give each train a clear distant signal, the time intervals between trains must be equal to the time required to run three times the length of one block, plus the length of the train, plus the distance run during the time (assumed to be 4 seconds) required for the home and the distant signals to move from the stop to the clear position.

A braking chart is also desirable. This shows the distances in which trains of various weights and lengths may be stopped by emergency and service applications of the brakes when running at various speeds. It is required in order to determine with reasonable certainty the distances that should be provided between the distant and the home signal and for the minimum lengths of block.

A paper location of the signals can first be made in the office to advantage, after which the ground should be carefully gone over to make sure that the signals can actually be placed in the position proposed, that the view is the best possible, and that there are no local conditions to interfere with the plan. * * *

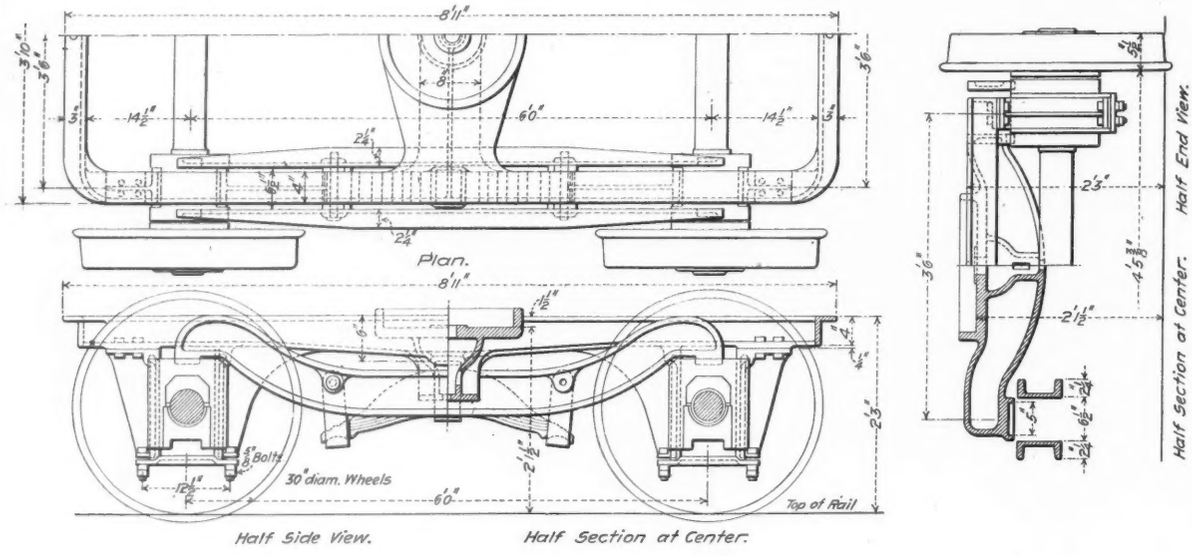
Symons Cast Steel Trucks.

The four-cylinder balanced compound locomotive built for the Plant System in 1902 by the Baldwin Locomotive Works had a boltless cast-steel tender truck designed by Mr. W. E. Symons, then Superintendent of Motive Power of that system. A number of car trucks of practically the same design were also in service at that time. However, the truck proved to be of rather too rigid construction for usual track conditions, the results of its trial at that time indicating the need of certain changes in order to adapt it better to service requirements. Mr. Symons has recently revised and perfected the design in the light of the results referred to and we present herewith the detail drawings.

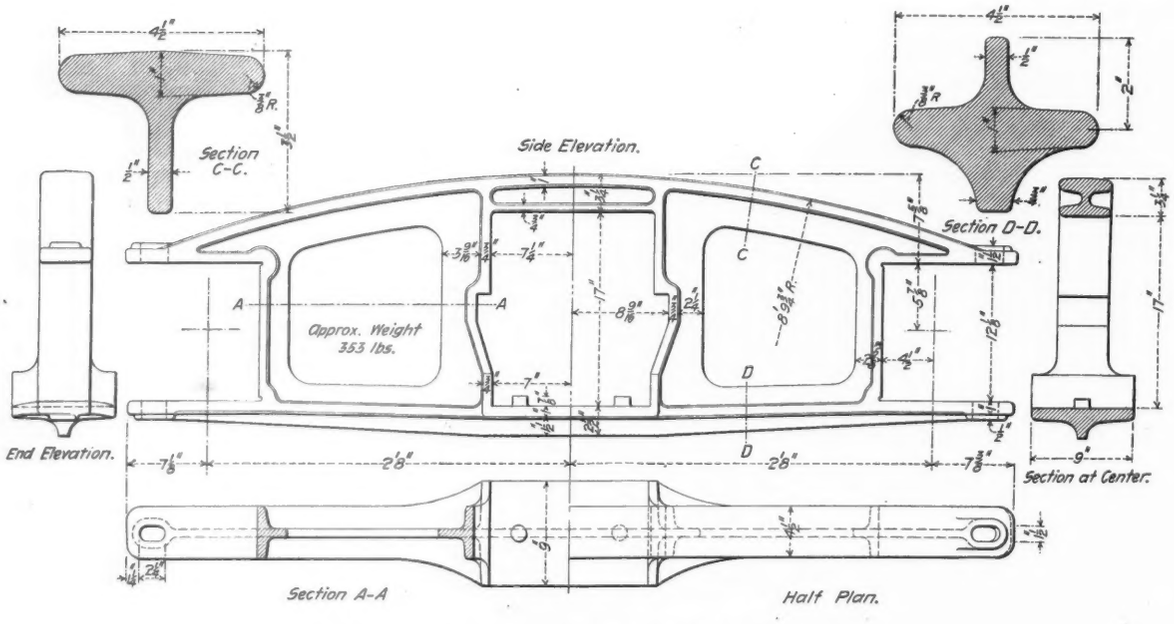
Simplicity of design in combination with maximum strength and the requisite flexibility were the principal objects sought. The side frame is formed in one piece. Its chief feature of peculiarity is the provision of horizontal jaws for the journal boxes, which are retained each by a wrought iron key of the form shown in the details. The most radical change from the first design has been in the transverse member of the truck frame, which originally was of cast steel. The present arrangement provides the requisite flexibility which was lacking in the previous design and also effects a material reduction in weight. Instead of a one-piece spring plank, two 5-in. x 3-in. x ⅜-in., 9.8-lb. angles are used, with the shorter leg up. Drawings of two different arrangements are shown. In one of these a 1⅜-in. hole in the longer leg of the angle, 4½ in. from the end, fits over a boss cast on the lower bar or tension member of the frame, the angles being 4 in. apart when in place. A cast-steel spring seat, a detail of which is shown, slips between the columns from the inner side of the frame. It rests on the angles, fitting between the vertical legs, and a lip on the outer side at the bottom drops down over the angle ends, coming flush with the top of the lower bar of the frame. The spring seat is held in place by two tapered wrought-iron keys driven between it and the columns.

In the other arrangement the spring seat is cast integral with the side frame, eliminating the keys and further reducing the weight by lightening certain of the sections. Openings for the angles are cored below the spring seat so that they occupy the same relative position as in the first arrangement. Each end will, however, be riveted at three points to the steel casting—one through the vertical leg to the spring seat, and one each at the inner and outer sides of the bottom bar of the frame, which, it will be noted, is 9 in. wide under the spring seat. The location of the rivets will be such that they may be inserted or removed from the outside or bottom, as the case may be.

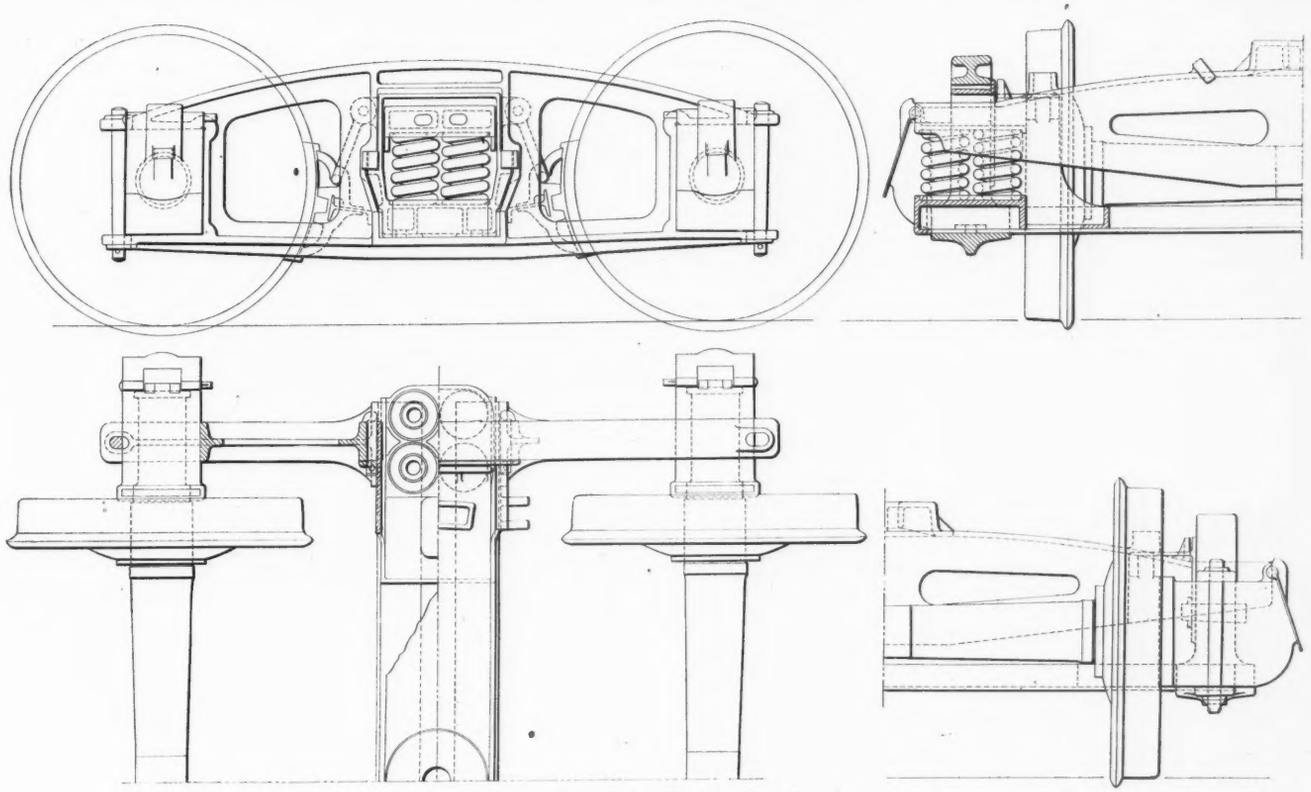
The bolster is cast in one piece, with the center plate and side bearings integral therewith. It will be noted that the center plate is placed in its natural position—that is, the reverse of the upside-down position in which most car builders persist in applying



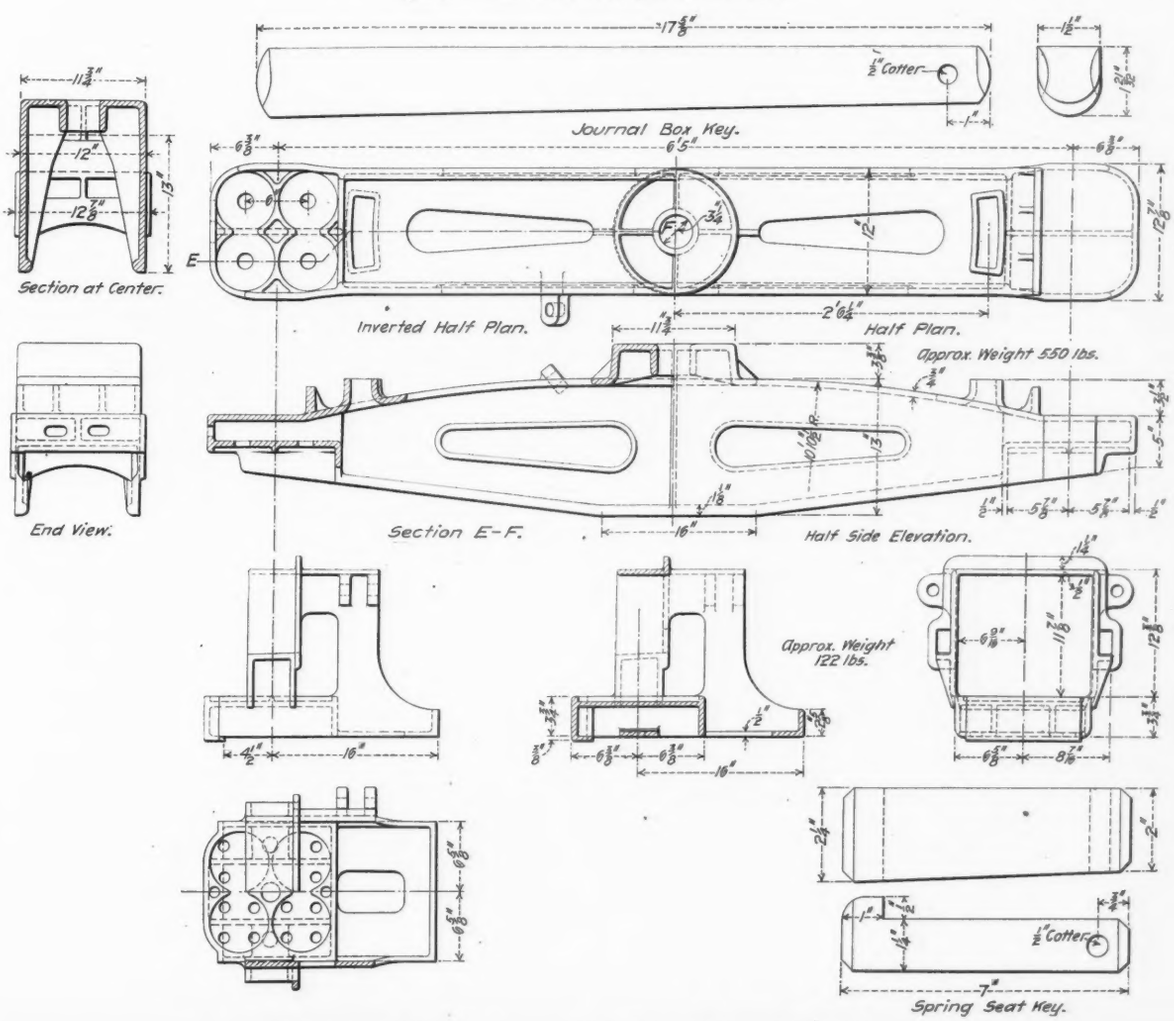
Symons Cast Steel Locomotive Truck.



Details of One-Piece Cast Steel Side Frame for Freight Car Truck.



Symons Cast Steel Freight Car Truck.



Details of Bolster of Symons Cast Steel Freight Car Truck.

it. Other features of the bolster are all plainly shown by the drawings.

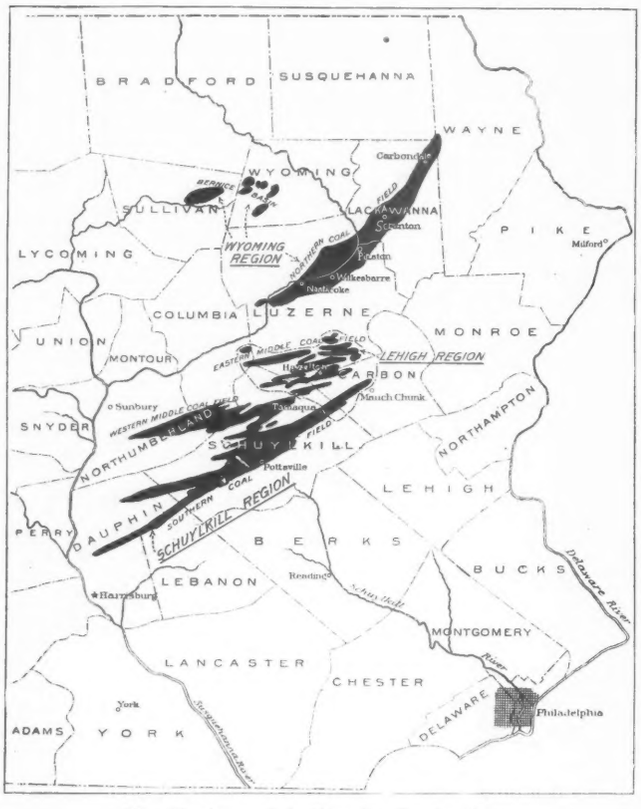
The rated capacity of the truck is 100,000 lbs. The areas of the different principal sections are indicated and the approximate weights of the various members set down. From these latter the approximate total weight of the frame would be 1,140 lbs., and including the bolster, 1,690 lbs. A liberal factor of safety was allowed in estimating all of the sections to permit a material reduction of the weight for lighter capacity cars.

Mr. Symons has also designed a four-wheel locomotive truck, the drawings for which are shown herewith. A principal object of the design was to provide a main frame of cast-steel formed in one piece in order to reduce greatly the number of parts to be fitted and thereby reduce the production and maintenance cost, while increasing the strength and durability of the truck. Also, the design will permit the application of the wheels and axles without having to jack up the truck a height equal to the length of the pedestals.

The main frame, as already mentioned, is a single casting. The inner pedestals are likewise an integral part of this casting. The outer pedestals, however, are removable, as the drawing shows, to permit the application and removal of wheels and axles without jacking up the truck. Each pedestal has near the top of the bearing plate a recess into which a lug of the corresponding shoe fits. The design and arrangement of equalizers, hangers, springs, etc., is clearly shown by the drawing.

The Anthractie Coal Fields of Pennsylvania.

In the *Railroad Gazette*, June 1, a list was printed of the principal coal carrying railroads of the country, together with as much additional statistical information about tonnage hauled and tonnage underlying as could be secured. One of the tables—that estimating the underlying anthracite belonging to each road—was attributed to Mr. W. W. Ruley, Chief of Bureau of Anthracite Coal Statistics. Mr. Ruley, however, informs us that he is not the author of this estimate. He has kindly furnished the following additional data, which shows excellently the general location of the anthracite fields and the annual output from each region from 1820 to 1905, inclusive, although the apportionment of holdings as between carriers and the unmined tonnage is not estimated.



The Regions of Anthracite Production.

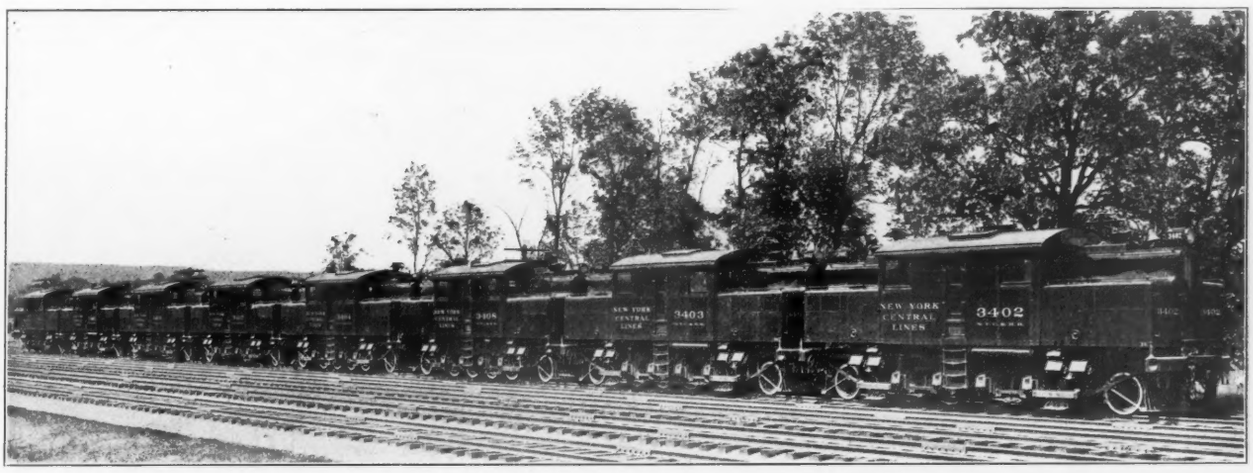
The accompanying table and map was compiled by Mr. Ruley under the direction of Mr. David T. Day, Chief of Division, and published by the United States Geological Survey. The Wyoming Region, as shown, embraces the entire northern coal field and the Bernice Basin. The Lehigh region embraces the eastern middle coal field and that part of the southern coal field lying between the Lehigh and the Little Schuylkill rivers. The Schuylkill region embraces the western middle coal field and that part of the southern coal field lying between the Little Schuylkill and the Susquehanna rivers. It will be noted that the Lehigh region was the first to be developed, starting with 365 tons in 1820, and growing to an output of 7,849,205 tons in 1905, the year of maximum production. The Wyoming region was not mined until 1829, but now gives much the most considerable annual tonnage, with a maximum of 35,857,897 tons in 1905. Until about 1867 the Schuylkill region, dating back to 1822, was the principal source of tonnage.

Total shipments.		Region—Wyoming.		Region—Lehigh		Region—Schuylkill	
Years.	Tonnage.	Tonnage.	Per ct.	Tonnage.	Per ct.	Tonnage.	Per ct.
1820..	365	.....	.....	365	.....	.....	.....
1821..	1,073	.....	.....	1,073	.....	.....	.....
1822..	3,720	.....	.....	2,240	60.21	1,480	39.79
1823..	6,951	.....	.....	5,823	83.77	1,128	16.23
1824..	11,108	.....	.....	9,541	85.90	1,567	14.10
1825..	34,893	.....	.....	28,393	81.40	6,500	18.60
1826..	48,047	.....	.....	31,280	65.10	16,767	34.90
1827..	63,434	.....	.....	32,074	50.56	31,360	49.44
1828..	77,516	.....	.....	30,232	39.00	47,284	61.00
1829..	112,083	7,000	6.25	25,110	22.40	79,973	71.35
1830..	174,734	43,000	24.60	41,750	23.90	89,984	51.50
1831..	176,820	54,000	30.54	40,966	23.17	81,854	46.29
1832..	363,271	84,000	23.12	70,000	19.27	209,271	57.61
1833..	487,749	111,777	22.91	123,001	25.22	252,971	51.87
1834..	376,636	43,700	11.60	106,244	28.21	226,692	60.19
1835..	569,758	90,000	16.05	131,250	23.41	339,508	60.54
1836..	684,117	103,861	15.18	148,211	21.66	432,045	63.16
1837..	869,441	115,387	13.27	223,902	25.75	530,152	60.98
1838..	738,697	78,207	10.59	213,615	28.92	446,875	60.49
1839..	818,402	122,300	14.94	221,025	27.01	475,077	58.05
1840..	864,379	148,470	17.18	225,313	26.07	490,596	56.75
1841..	959,773	192,270	20.03	143,037	14.90	624,466	65.07
1842..	1,108,412	252,599	22.79	272,540	24.59	583,273	52.62
1843..	1,263,598	285,605	22.60	267,793	21.19	710,200	56.21
1844..	1,630,850	365,911	22.43	377,002	23.12	887,937	54.45
1845..	2,013,013	451,836	22.45	429,453	21.33	1,131,724	56.22
1846..	2,344,005	518,389	22.11	517,116	22.07	1,308,500	55.82
1847..	2,882,309	583,067	20.23	633,507	21.98	1,665,735	57.79
1848..	3,089,238	685,196	22.18	670,321	21.70	1,733,721	56.12
1849..	3,242,966	732,910	22.60	781,556	24.10	1,728,500	53.30
1850..	3,358,899	827,823	24.64	690,456	20.56	1,840,620	54.80
1851..	4,448,916	1,156,167	25.98	964,224	21.68	2,328,525	52.34
1852..	4,993,471	1,284,500	25.72	1,072,136	21.47	2,636,835	52.81
1853..	5,195,151	1,475,732	28.41	1,054,309	20.29	2,665,110	51.30
1854..	6,002,334	1,603,478	26.73	1,207,186	20.13	3,191,670	53.14
1855..	6,608,567	1,771,511	26.80	1,284,113	19.43	3,553,943	53.77
1856..	6,927,580	1,972,581	28.47	1,351,970	19.52	3,603,029	52.91
1857..	6,644,941	1,952,603	29.39	1,318,541	19.84	3,373,797	50.77
1858..	6,839,369	2,186,094	31.96	1,380,030	20.18	3,273,245	47.86
1859..	7,808,255	2,731,236	34.98	1,628,311	20.86	3,448,708	44.16
1860..	8,513,123	2,941,817	34.56	1,821,674	21.40	3,749,632	44.04
1861..	7,954,264	3,055,140	38.41	1,738,377	21.85	3,160,747	39.74
1862..	7,869,407	3,145,770	39.97	1,351,054	17.17	3,372,583	42.86
1863..	9,566,006	3,759,610	39.30	1,894,713	19.80	3,911,683	40.90
1864..	10,177,475	3,960,836	38.92	2,054,669	20.19	4,161,970	40.89
1865..	9,652,391	3,254,519	33.72	2,040,913	21.14	4,356,959	45.14
1866..	12,703,882	4,736,616	37.29	2,179,364	17.15	5,787,902	45.56
1867..	12,988,725	5,325,000	40.99	2,502,054	19.27	5,161,611	39.74
1868..	13,801,465	5,968,146	43.25	2,502,582	18.13	5,330,737	38.62
1869..	13,866,180	6,141,369	44.28	1,949,673	14.06	5,775,138	41.66
1870..	16,182,191	7,974,660	49.28	3,239,374	20.02	4,968,157	30.70
1871..	15,699,721	6,911,242	44.02	2,235,707	14.24	6,552,772	41.74
1872..	19,669,778	9,101,549	46.27	3,873,339	19.70	6,694,890	34.03
1873..	21,227,952	10,309,755	48.57	3,705,596	17.46	7,212,601	33.97
1874..	20,145,121	9,504,408	47.18	3,773,836	18.73	6,866,877	34.09
1875..	19,712,472	10,596,155	53.73	2,834,605	14.38	6,281,712	31.87
1876..	18,501,011	8,424,158	45.53	3,854,919	20.84	6,221,934	33.63
1877..	20,828,179	8,300,377	39.85	4,332,760	20.80	8,195,042	39.35
1878..	17,605,262	8,085,587	45.92	3,237,449	18.40	6,282,226	35.68
1879..	26,142,689	12,586,293	48.14	4,595,567	17.58	8,960,829	34.28
1880..	23,437,242	11,419,279	48.72	4,463,221	19.05	7,554,742	32.23
1881..	28,500,017	13,951,383	48.96	5,294,676	18.58	9,253,958	32.46
1882..	29,120,096	13,971,371	47.98	5,689,437	19.54	9,459,288	32.48
1883..	31,793,027	15,604,492	49.08	6,113,809	19.23	10,074,726	31.69
1884..	30,718,293	15,677,753	51.04	5,562,226	18.11	9,478,314	30.85
1885..	31,623,530	16,236,470	51.34	5,898,634	18.65	9,488,426	30.01
1886..	32,136,362	17,031,826	53.00	5,723,129	17.81	9,381,407	29.19
1887..	34,641,018	19,684,929	56.82	4,347,061	12.55	10,609,028	30.63
1888..	38,145,718	21,852,366	57.29	5,639,236	14.78	10,654,116	27.93
1889..	35,817,093	19,036,835	53.15	6,294,073	17.57	10,486,185	29.28
1890..	36,615,459	19,417,979	53.03	6,329,658	17.29	10,867,822	29.68
1891..	40,448,336	21,325,240	52.72	6,381,838	15.78	12,741,258	31.50
1892..	41,893,320	22,815,460	54.46	6,451,076	15.40	12,626,784	30.14
1893..	43,089,537	23,839,741	55.32	6,892,352	16.00	12,357,444	28.68
1894..	41,391,200	22,650,761	54.72	6,705,434	16.20	12,035,005	29.08
1895..	46,511,477	24,943,421	53.63	7,298,124	15.69	14,269,932	30.68
1896..	43,177,485	23,589,473	54.63	6,490,441	15.03	13,097,571	30.34
1897..	41,637,864	23,207,263	55.74	6,249,540	15.01	12,181,061	29.25
1898..	41,899,751	23,567,767	56.25	6,253,109	14.93	12,078,875	28.82
1899..	47,665,204	26,578,286	55.75	6,887,909	14.44	14,199,009	29.81
1900..	45,107,484	24,686,125	54.73	6,918,627	15.33	13,502,732	29.94
1901..	53,568,601	30,337,036	56.63	7,211,974	13.45	16,019,591	29.92
1902..	31,200,890	19,258,763	61.73	3,470,736	11.12	8,471,391	27.15
1903..	59,362,831	35,723,258	60.18	7,164,783	12.07	16,474,790	27.75
1904..	57,492,522	34,006,009	59.15	7,107,220	12.36	16,379,293	28.49
1905..	61,410,201	35,857,897	58.39	7,849,205	12.78	17,703,099	28.83

The Shantung Railroad, which the Germans have built in China, in 1905 carried 803,527 passengers and 310,482 tons of freight, against 558,868 passengers and 179,270 tons of freight in 1904, when, however, the whole road was open only part of the year. More than half the freight in 1905 was coal, viz., 158,115 kilometric tons, from mines reached by the railroad. The other chief freights were beans, oil, cotton, straw goods and crockery. The gross earnings were $1,912,296 Mexican, equal to one-half that sum in our currency. Less than one-third of the earnings were from passengers. The gross earnings per mile were $7,055 Mexican; the working expenses $3,355, leaving $3,700 net, or $1,850 in our currency. This sufficed for a dividend of 3¼ per cent.

Electric Locomotives for the New York Central.

Last October the first half of the 50,000-mile endurance run of the first high-speed electric locomotive, No. 6,000, built jointly by the General Electric Company and American Locomotive Company, was completed on the test tracks of the New York Central lines in Schenectady. On June 12 this locomotive completed the second half of this exhaustive service test. The maintenance expense per mile for the complete 50,000-mile run amounted to $0.0126. This figure includes all maintenance expense on motors, brake shoes, tires, inspection and other miscellaneous items. Moreover, the operating conditions were much more severe than those to which the thirty-five electric locomotives, which have been ordered, will be subjected. The test locomotive hauled a train averaging from 200 to 400 tons over a six-mile track and high-speed running under these conditions involved higher braking and accelerating duty than in regular operating service. The accompanying illustration shows eight of the thirty-five 100-ton, 2,200 h.p. electric locomotives which the manufacturers have built for the New York Central lines, following the same design as the locomotive No. 6,000, which has made such a satisfactory record. There are in all fourteen machines now complete. Of the eight locomotives shown, Nos. 3,401 and 3,402 have been shipped to New York. The remaining locomotives are well under way at the shops of the General Electric Company and American Locomotive Works, and it is expected that the complete number, thirty-five, will be ready for service in early October.



Eight Electric Locomotives for the New York Central Awaiting Shipment.

The Air Power Plants for the East River Tunnels of the Pennsylvania Railroad.

In the description of the general features of the East river tunnels of the Pennsylvania Railroad in our issue of July 6, reference was made to the enormous power plant required on each side of the river for supplying compressed air to the tunnel headings. These pneumatic power plants are the largest ever installed for any purpose.

Among the clauses in the specifications for the tunnels relating to the power plants were the following:

"The plant to be installed and operated by the contractor shall be the best of its kind for the work to be done."

"Where work is done in compressed air, it shall be carried on day and night without any interruption or intermission."

The general demands of the power situation were covered in the following six clauses:

The contractor must provide at each shaft an adequate plant, including boilers, air compressors, hydraulic machinery, dynamos and all other necessary plant, with a reasonable duplication to meet unusual and unexpected emergencies.

"The air compressors shall be of sufficient capacity to deliver regularly into each heading at least 300,000 cubic feet of free air per hour at a pressure of 50 lbs. per square inch above the normal air pressure, and a larger amount if found necessary during the progress of the work. The air for the compressors must be drawn from the exterior of the power house and the intake so located as to give pure air. The air shall be cooled, and oil and other impurities removed, as completely as practicable, before delivering it into the headings.

"In order to provide a reasonable margin for repairs and contingencies, a spare compressor and boiler plant shall be provided at each shaft and kept in good condition and repair, ready for immediate use. The capacity of the spare plant shall be 25 per cent. of that required in the preceding paragraph for regular operation.

"Provision must be made for storing in tanks at each boiler-house enough feed water for 12 hours supply, unless connections can be made with two independent and sufficient sources of supply.

"The air shall be delivered into each heading through two supply pipes of such capacity that the velocity of the air through them in regular working shall not exceed 40 feet per second. These pipes shall be tapped with regulating valves in each intermediate air chamber in tunnels and sufficient air admitted to ventilate it and to maintain the pressure required. If required by the engineer, air shall be delivered at the shield in each section or compartment thereof where men are employed, and withdrawn therefrom in special exhaust pipes with suitable regulating valves."

It is to be noted that the specifications called for 300,000 cu. ft. of free air per hour, delivered under a pressure of 50 lbs. to each heading, making a total for the East river tunnels of 2,400,000 cu. ft. per hour to be supplied by the two air plants, this being equivalent to an effective net piston displacement in each of the compressors of 4,000 cu. ft. of free air per minute. This enormous volume of air was to be used to keep out the water by counterbalancing the hydraulic head on the outside and also for the ventilation of the headings. While the greater part of the work has been through the soft sand or quicksand of the river bottom, preliminary soundings showed that there would be considerable rock encountered in the tunnels, in the removal of which the rock drill became a necessity. In addition to the low-pressure compressors, therefore, it was necessary to supply a source of high-pressure air for operating these latter machines. The peculiarities of this service will be discussed later.

The magnitude of the work, the difficulties under which it was to be carried on, and the limiting period within which it was to be finished, necessitated the employment of the best engineering skill acquired along all the lines of previous similar experience, and demanded a power equipment larger in capacity than anything heretofore known for similar purposes and embodying many features unique in pneumatic practise. The Manhattan plant, located in New York City at 32d street and First avenue, at the western approach to the East river tunnels, is probably the most complete embodiment of the methods designed to meet the exacting requirements of the specifications. It may therefore serve as a type, not only of the power plants used on this work, but also of the most approved practice in pneumatic power production and distribution, and a detailed description of this installation is therefore here given.

The engineers were confronted in the beginning by the very difficult and discouraging problem of making a power plant which must fulfil certain fixed conditions and fit a given space, instead of following the natural method of selecting a space to meet the requirements of a given power plant. This apology—if it need be so considered—is offered at this point to explain some seeming departures from approved power plant design and arrangement which may appear, in the course of the description, to the practised eye of the constructing engineer. The accompanying plan shows in assembled detail the limitations of space which confronted the designer and the arrangement of machinery and appliances which this space necessitated.

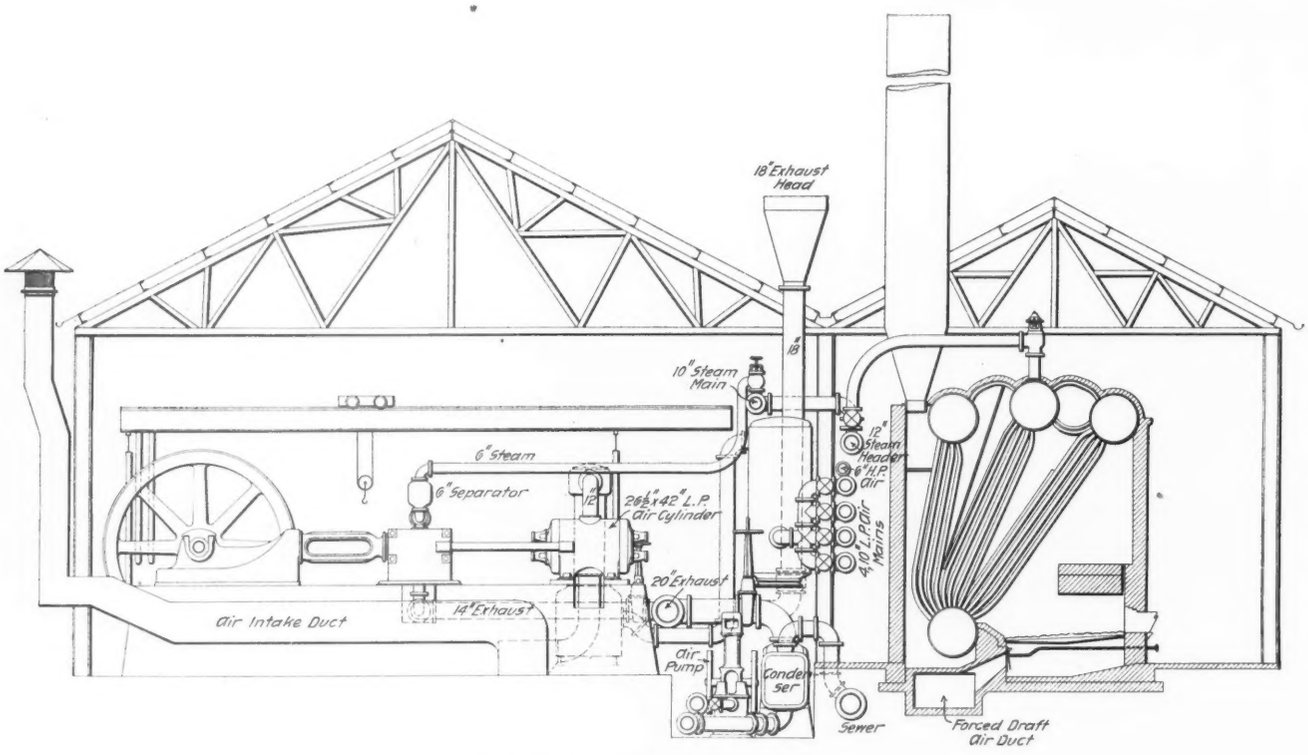
The original boiler equipment of the Manhattan plant included five water-tube boilers of 500 h.p. capacity each, this rating being based upon the accepted value of the boiler horse-power as the capacity for evaporating 34½ lbs. of water per hour from and at 212 degrees Fahr. Each boiler has an approved setting and is equipped with shaking grates and draft appliances designed for burning the smaller sizes of anthracite coal. Each boiler is equipped

with a "non-return emergency stop valve" designed to automatically close should there be a sudden rush of steam backward toward the boiler on which it is mounted, as in the event of a boiler tube bursting. In such cases this valve prevents the discharge of the steam from the other boilers through the steam header to the injured unit. The boilers generate steam at 150 lbs. pressure and were furnished under a guarantee to operate at 50 per cent. overload for a limited period. Forced draft is furnished by two independent steam-driven fans, supplemented by independent steel stacks for each boiler, 54 in. in diameter and 100 ft. high. Each fan has a capacity of 28,000 cu. ft. of air per minute, delivered at 1½ ozs. pressure. One fan, however, is sufficient to furnish the necessary draft, leaving the other as a reserve. The air for the forced draft is carried through a large duct in the hollow bridge wall of each boiler and discharged into the ash-pit through two adjustable draft dampers arranged to give the best possible distribution of air under the grates. Each boiler is also furnished with a feed-water controller, which automatically maintains the water level at a fixed point by means of a float in the water column actuating a valve in the feed connection to the boiler, this in turn regulating the speed of the pump through a pump governor.

Three duplex feed pumps of the outside-packed plunger pattern, brass fitted throughout, and each provided with a pump governor, handle the water supply to the boilers. One of these units is sufficient to supply the plant, leaving two in reserve for emergencies. The feed water is heated in an open feed-water heater of 2,000 h.p. capacity. Exhaust steam enters this heater from the boiler feed pumps, the circulating pumps, the air pumps, the fan engines and other auxiliary machinery. Any heater overflow is carried to the secondary hot well. There is thus no loss of steam or water from the system except a small amount due to leakage.

The main hot well is a tank of heavy steel and will receive all the water of condensation from the condensers. Duplex brass-fitted pumps of ample capacity lift the water of condensation from the main hot well to the main heater, each pump being controlled by a float in the hot well. Three surface condensers, each of a rated capacity of 1,800 h.p., are installed in the position shown on the plan, close to the fire wall between engine and boiler rooms, in a pit below the engine-room floor. Each condenser has an individual air pump driven by a vertical engine, the whole arrangement maintaining in practise a vacuum of 26 in. Either one of the three condensers serves as a reserve unit. Condensing water for the plant is drawn from the East river through an 18-in. water main several hundred feet in length; and provision for handling it was made by installing two centrifugal circulating pumps, each with a capacity of 3,000 gallons per minute and each driven by an independent vertical engine. With condensing water at 70 degrees Fahr., one of these circulating pumps has a capacity ample to supply two condensers running at the rated capacity. In addition to these condenser circulating pumps there is installed a separate steam-driven centrifugal pump with independent engine, having a capacity of 1,000 gallons per minute, which draws cold water from the river through a 10-in. pipe main and circulates it through the jackets and coolers of the compressor units. It will be noted that there is no provision for a reserve unit at this point; but the piping arrangements are such that should this jacket circulating pump be disabled its load can be taken by one of the main condenser circulating pumps.

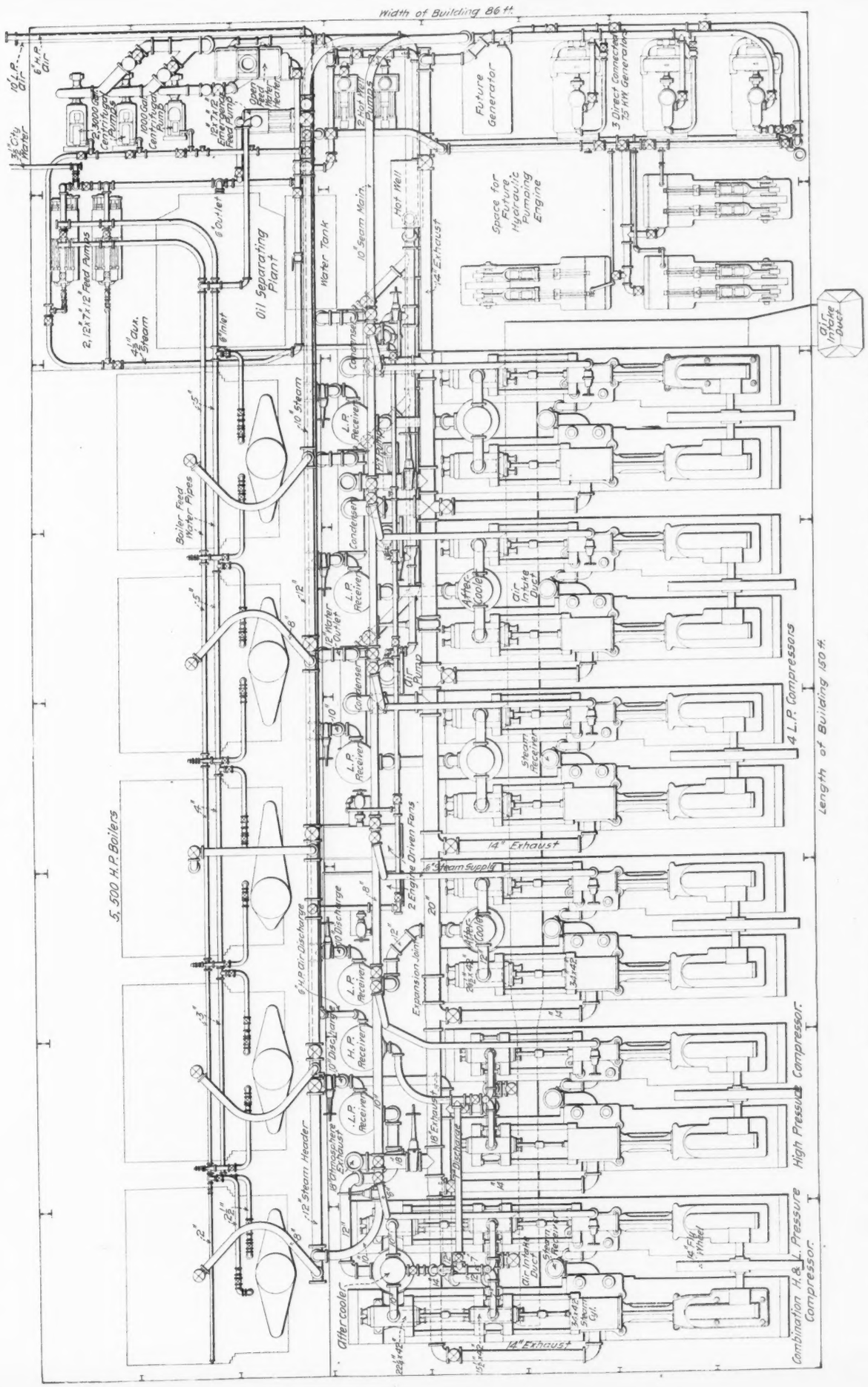
The steam supply pipes are laid out on a loop system, which makes it impossible for a broken steam header to cripple the plant. The general arrangement of the piping is shown in the plan. Wide-sweep bends unite the boilers and the steam header. The main header has a maximum diameter of 12 in., which diminishes to 10-in. and 8-in. diameters in the farther sections. The arrangement of valves and piping is such that any compressor can be cut out without interfering with the operation of any other machine, while in case of a break in the steam header at any point it can be shut off by means of a valve on either side of it and the steam supply maintained through the two branches of the loop. Pockets provided at proper points receive entrained moisture and condensation, which is removed through a proper system of drip piping. Not only are the main units of the power station connected up on the loop system, but all auxiliaries also are supplied through duplex pipe systems, this preventing a shut-down due to a broken steam pipe anywhere.



Cross-Section Through Power Plant.

Standard pipe is used throughout, made up with extra heavy fittings and valves, the latter bronze-seated and of gate pattern. All steam piping is covered with a non-conducting material bound with heavy canvas. The supply pipes from the header to all the main units are made up with wide-sweep bends and are of ample cross-section. Strains due to expansion and contraction are properly provided for in the layout of the loop scheme. The main exhaust steam header has a maximum diameter of 20 in., diminishing to 18 and 10 in. in the remoter sections. It receives all the exhaust which is to enter the condensers, and is provided with two automatic atmospheric connections, so that all the machinery can at once exhaust into the atmosphere in case of the simultaneous shutting down of all the condensers. By a proper arrangement of valves and condenser piping any or all of the condensers may be cut out.

The feed-water system is entirely automatic in operation. The boiler feed supply is automatically regulated by a feed-water controller and pump governor. The heater is supplied by means of the hot-well pump under control of a float in the hot well. Fresh water to make up for leakage in the system is supplied to the heater automatically by means of a float-controlled valve in the latter. The piping is so arranged that the boiler feed pumps can be supplied direct from the city mains, and there are also connections for filling



Plan of Manhattan Power Plant for Pennsylvania East River Tunnels—S. Pearson & Son, Contractors.

empty boilers from the city mains without the use of the pumps. There are two independent pipe lines between the pumps and the boilers.

Feed water is supplied to the boilers as follows: The condenser discharge flows directly to the hot well; from the hot well it is elevated by a pump to the heater; from the heater it flows by gravity through the oil separator to the feed-pump suction; from the feed pump it is forced into the boilers.

The power equipment proper for the Manhattan station includes, besides the compressors about to be described, three powerful steam-driven hydraulic machines for furnishing pressure to the hydraulic jacks which force the shields forward in the tunnels. There are in addition four vertical direct-connected electric generating sets furnishing current to light the workings.

Air Compressors.—Six compressor units make up the air-power equipment. These were all made by the Ingersoll-Rand Company, of New York, and embody the latest refinements which guarantee the highest economy and reliability in air compression. Before entering into the details of these machines a discussion of the conditions which were to be met may be of interest and of assistance in understanding the somewhat peculiar arrangement of power-producing devices. The pressure requirements of the service were unique and exacting. As stated, the tunnels are being driven by the shield method, with the air pressure inside balancing the water pressure outside. Evidently as the tunnels descended under the river, the pressure due to the head of water above would steadily increase, until the maximum depth was reached, requiring a corresponding increase in the counterbalancing air pressure. Moreover, it was recognized that as the four tunnels progressed, the same rate of advance might not be maintained in all of them, because of the varying materials and conditions encountered, and it was quite possible, therefore, that each heading might require a different and a differently varying pressure. The rock drills and other pneumatic appliances which were to operate behind the shield and in the working chamber of the heading would exhaust into this working pressure; and in order that they might be maintained at their maximum effectiveness a constant effective working pressure had to be maintained upon them, regardless of the varying terminal pressures at which they might exhaust. Briefly summed up, the requirements of the situation were for two sources of air pressure, the pressures differing by a constant value and capable of simultaneously varying between the maximum and minimum; and these were the conditions which necessitated the adoption and arrangement of air compressors.

Four of the compressors are low air presure machines of duplex Corliss type, with cross-compound steam cylinders designed to operate condensing, and simple duplex air cylinders discharging into their individual after-coolers. The steam valve gear is of the Corliss release type with vacuum dash pots; the air valve gear is that known by the makers as the positive pneumatically operated type. The steam cylinders are 16 in. and 34 in. in diameter, respectively, by 42-in. stroke, and the common diameter of the duplex air cylinders is 26¼ in. At the normal rated speed of 100 r.p.m. each of these machines has an actual free air capacity of 5,000 cu. ft. per minute, and is designed to deliver the air at a working pressure ranging from atmosphere to 50 lbs. The machines are so designed, however, that cut-off of maximum economy prevails when an air pressure of 30 lbs. is being delivered; either side of this point the steam economy naturally falling off slowly. The initial steam pressure is 150 lbs. gage, and the engines operate under a 26-in. vacuum. When operating at the above-rated speed under a uniform load of 30 lbs. pressure, with standard steam pressure and vacuum, each compressor develops about 480 i.h.p. The supply of steam to the engine is automatically adjusted to the load upon it, and the air pressure is automatically maintained at the proper value by means of a speed and air-pressure regulator of a type designed especially for difficult service under widely differing loads. While 100 r.p.m. is the rated speed of these compressing units, the specifications required that they could be safely and economically run at a speed of 125 r.p.m. for a period of 24 hours continuously, and this condition has frequently been completely satisfied in practice. The vertical receiver-after cooler for each unit is placed between its air cylinders. Solid concrete foundations support the entire compressor installation.

In addition to these four low-pressure machines there is also installed one high-pressure unit of the same general type; duplex Corliss pattern with steam cylinders cross-compound to operate condensing and simple duplex air cylinders; Corliss release valve gear and vacuum dash-pots on the steam end, and positive pneumatically operated valves on air intake and discharge. A combined speed-and-air pressure regulator, of the type already mentioned, automatically regulates the performance of the unit. The high-pressure steam cylinder is 16 in. in diameter, low pressure 34 in. in diameter; the air cylinders are 15½ in. in diameter and the common stroke is 42 in. The normal speed of this compressor is 90 r.p.m., at which it has a piston displacement of 1,568 cu. ft. of free air per minute from atmospheric intake. It is designed to cover a working range of air pressure from 90 to 140 lbs., with intake pressures varying from atmosphere to 50 lbs., and under these conditions the equivalent free air capacity of the machine will vary from 1,568 to 6,899 cu. ft. per minute. The normal rating of the compressor is at a terminal pressure of 120 lbs., compressed from intake pressure of 30 lbs. At this point the machine has a cut-off of maximum economy when operating under a steam pressure of 150 lbs. and a vacuum of 26 inches. This unit also was designed to stand, and has repeatedly stood an overload up to 125 r.p.m. for a continuous period of 24 hours. The drill capacity of this compressor is stated at thirty-six 3½-in. standard Sargeant rock drills when the air is compressed from an initial pressure of 20 to 35 lbs. and with a differential or effective pressure on the drill not exceeding 90 to 100 lbs. gage. The air discharge pipes from the high-pressure cylinders unite in a common branch leading to a high-pressure receiver in the rear of the compressor.

Supplementing the five machines described, and intended to act on occasion as a reserve for either the high or the low-pressure sections of the plant, there is installed a machine classed in the specifications as a "combination high and low-pressure compressor." Its general type is similar to that of the other machines. The steam cylinders, 16 in. and 34 in. in diameter, with a common stroke of 42 in., are cross-compounded and run condensing. They are fitted with Corliss release gear and vacuum dash-pots, and are coupled in tandem to a pair both of high and low-pressure air cylinders, the high-pressure air cylinders being next to and in line with the steam cylinders. The air cylinders are 15½ in. and 22¼ in. in diameter, with a common stroke of 42 in. The design contemplates either running all four air cylinders connected, as a low-pressure machine, or as a high-pressure machine with the larger air cylinder disconnected and only the two 15½-in. cylinders in operation, drawing intake from the low-pressure machines or direct from the atmosphere. When operating as a low-pressure unit at the rated normal speed of 100 r.p.m., this compressor has a total actual capacity of 5,000 cu. ft. of free air per minute from atmospheric intake, and covers a range of terminal pressures from atmosphere to 50 lbs. When operating as a high-pressure unit at the normal rated speed of 90 r.p.m., the machine has a free air capacity of 1,568 cu. ft. per minute, with atmospheric intake and a discharge pressure of 90 lbs.; but it is capable of variation up to a terminal pressure of 140 lbs. from an intake of 50 lbs., at which its equivalent free air capacity is 6,899 cu. ft. per minute. The engine has its cut-off at maximum economy when operating under steam pressure of 150 lbs. and vacuum of 26 in., with air intake of 30 lbs., gage, and discharge pressure of 120 lbs. Under these conditions it develops 430 i.h.p. Like the other compressor units, it can be and has been overloaded for a period of 24 hours up to a speed of 125 r.p.m. A vertical receiver after-cooler, mounted between the low-pressure cylinders, receives their discharge when the machine is run as a low-pressure unit. When run as a high-pressure machine, the discharge is delivered into the high-pressure receiver already noted as connected with the high-pressure unit. It will be observed that there is no provision for after-cooling the high-pressure air, as the moisture is sufficiently removed in the after-coolers of the low-pressure machines from which the high-pressure units draw their intake, and the exhaust from the high-pressure machines used in the heading is cooled in its expansion.

It is to be remembered that the air delivered by the low-pressure compressors comprises the entire atmosphere of the headings in which the men work, and the pressure alone to which they are subjected is sufficiently trying without any additional complications from high temperature, humidity, oil vapor or other impurities, and all possible provision is made for delivering the air as cool and pure as possible.

Cool and clean intake air is supplied to each compressor through an 18-in. branch leading from a large air intake conduit traversing all the foundations and terminating in a 40-in. vertical-hooded and screened pipe outside the building. The after-coolers use salt water for the cooling, and they are therefore fitted with tubes and tube plates of special composition to resist corrosion. Each after-cooler reduces the temperature of the air which it receives from the low-pressure cylinder very nearly to that of the cooling water employed, and for most of the year this air temperature is decidedly below that of the external atmosphere.

There are five vertical steel low-pressure air receivers 54 in. diameter and 12 ft. high, mounted at the rear of the compressors and close to the fire wall, as shown in the plan. The cooled air from the after-coolers enters these low-pressure receivers at the top and is discharged near the bottom. The passage of the air through the receivers is slow, and here all surplus moisture is dropped, the traces of oil also mostly disappearing, drain cocks being provided with each receiver for drawing off the accumulation from time to time. The air discharge is into a four-way fitting of extra heavy tees, elbows and valves, the function of this four-way arrangement appearing later. There is a vertical high-pressure receiver 60 in. diameter and 14 ft. high, located at the rear of the high-pressure unit.

The high-pressure machines draw their intake from the discharge of the low-pressure machines. This system is equivalent

in effect and economy to two-stage compression, while giving a range of capacity under fluctuating pressures and a flexibility under varying service conditions which could not have been secured by an ordinary multi-stage unit. Until water pressure was encountered in the tunnels there was no necessity for an air pressure in front of the shield, and the rock drills were operated under an initial pressure of 90 to 100 lbs. supplied from the high-pressure compressor. As the depth has increased and low air pressure has been demanded in the chamber at the rear of the shield, this low-pressure has been supplied from the low-pressure machines, from which also the high-pressure compressor when in operation draws its intake. Thus, when the depth required a pressure at the face of 10 lbs., this became also the intake pressure of the high-pressure machine, which then had a discharge pressure of 100 lbs., which was equivalent to 90 lbs. effective pressure on the drill. With a tube pressure at 20 lbs., which was then also the intake pressure of the high-pressure machine, the high-pressure delivery became 110 lbs., leaving still an effective differential of 90 lbs., and so on over the full range of chamber pressures from zero to 50 lbs. and of high-pressures from 90 to 140 lbs. gage. With this understanding of the varying pressure requirements, as the work has progressed, and bearing in mind the fact that the varying progress and conditions in the four different headings has introduced other elements of variation, some idea may be formed of the complex demands which were arranged for in providing air power, and the necessity for a great flexibility in the piping system and in the scheme of distribution will be appreciated.

From the after-cooler of each low-pressure compressor a 12-in. pipe leads to the receiver. From each receiver a 10-in. branch discharges through the four-way fitting mentioned above into four 10-in. air mains running the length of the engine-room and leading one to each tunnel. The system of subdivision and control is such that any individual low-pressure compressor may furnish air to any tunnel at any required pressure, while either high-pressure machine may also draw its intake from any low-pressure compressor and deliver it, with the correct differential, to any heading. The high-pressure main from the high-pressure compressors is a 6-in. pipe carried out and branched to each tunnel. The intake connections for the high-pressure and combination compressors are so arranged that these machines can draw their intake from atmosphere, if necessary, while the high-pressure machine also is so piped that it can discharge into the low-pressure mains.

All air cylinders are completely water-jacketed and cooled by a continuous and copious flow of cold water from the river, maintained by the circulating pump already noted. Three separate oiling systems are installed in the plant, these being made necessary by the varying conditions of lubrication. The first supplies engine oil to all journals and oil cups where this grade of lubricant is used. Oil flows by gravity from an elevated tank, passes through the bearings, is caught and cleansed by a filter and is returned to the supply tank by a small oil pump. The second is a forced lubrication system for the air cylinders, in which air-oil, contained in tanks under air pressure from the high and low-pressure receivers, respectively, flows into the high and low-pressure cylinders; a large percentage of this oil is recovered in the drain of the after-coolers and is used for lubricating the rock drills and other air appliances in the headings. The third system is one for lubricating the steam cylinders and is simply a gravity arrangement of piping by which the cylinder oil flows from a tank to the reservoirs of the individual oil pumps fitted to each cylinder. This oil, after passing in the exhaust to the condenser, is removed from the condenser discharge by an elaborate automatic chemical oil separating plant, the location of which is seen on the plans.

Long Island City Plant.—The air power plant at the Long Island terminus of the tunnels is located at the foot of Flushing street, Long Island City. In its capacity and in all its essential features this plant is identical with that on the Manhattan side just described. But here again the engineers were confronted by the difficulty of making the plant fit a given space, and the result is a power station differing radically in arrangement from that on the other side of the river, this plant, as a whole, being very long and narrow, while the other is more nearly square. Enough has been said in reference to the Manhattan plant to make it unnecessary to enter into a full description of the Long Island installation. It is identical in capacity and capability with the plant on the New York side.

In the preceding description only the details of the plants as originally installed have been included. Mention should be made of two straight-line, Class A, Ingersoll compressors, 18 by 18¼ by 24-in. in the Manhattan plant. These were used for some of the preliminary shaft or tunnel work and have been retained as possibly serviceable in some emergency.

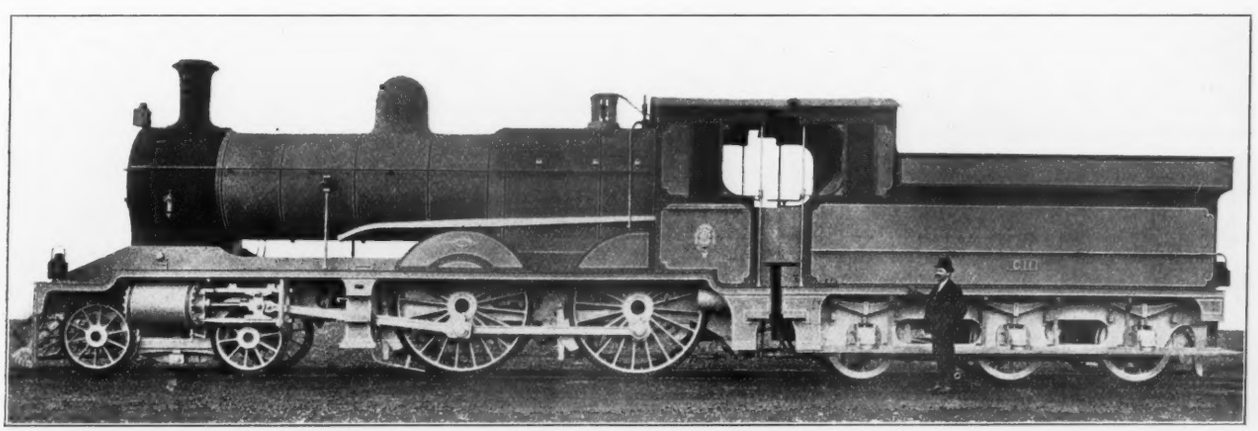
The complete success of the entire plants from the beginning is indicated in the fact that there have been no changes or substitutions in the line of correction or improvement. With the usual allowance for the breaking in of an installation, new in every detail, and some of it novel besides, everything has worked perfectly from the beginning, and all the changes have been in the line of additions and enlargements only. The call for low-pressure air has greatly exceeded all calculations, and accordingly at both the Manhattan plant and that at Long Island City an additional low-pressure compressor has been installed, in each case a precise duplicate of the four original low-pressure machines. At the Manhattan plant, also, the high-pressure cylinders, 15½ in. diameter, of compressor No. 5 have been taken off and cylinders 26¼ in. diameter for low-pressure service have been substituted. An additional boiler also has been added to each plant.

The four power plants employed in driving the tunnels for the Pennsylvania Railroad under the North river and the East river, only the latter of which have been here spoken of in detail, represent in the aggregate the largest installation of air-compressing machinery ever made. In settling the details of these plants the most far-seeing business considerations prevailed. Not a detail was knowingly omitted in design or arrangement which could measurably contribute economy and reliability in operation. Continuous service and a positive practical guarantee against breakdown were absolute essentials, for a sudden failure of air pressure in the working faces would inevitably have resulted in heavy loss of life and property, to say nothing of the loss of time which in this case would be "big money." Never was an air plant called upon for such severe service.

The fulfilment and even the overrunning of all expectations under the strenuous conditions which were anticipated and the unforeseen requirements which have arisen constitute a notable achievement of modern mechanical engineering and is peculiarly gratifying to all who have contributed to its success.

Locomotive for Imperial Chinese Railways.

Robert Stephenson & Co., Ltd., of Darlington, England, have recently built ten eight-wheeled (4-4-0) locomotives for the Imperial Chinese Railways. Though built in England, the engines bear the marks of American influence in the pilot and the arrangement of the running gear. The cab is arranged with side doors opening outward, for the convenience of the native Chinese firemen that are employed. The engines are fitted with the Westinghouse brake, the pump being fixed to the right hand side of the firebox clear of the reach rod, which, it will be seen, is on the left hand side. The



Eight-Wheel Locomotive for the Imperial Chinese Railways.

engines are intended for service on the 198 miles of road between Shanghai and Nankin, and are interesting as illustrative of the type to be used.

The following are some of the principal dimensions:

Cylinders, diameter	18 in.
Piston stroke	26 "
Steam pressure	180 lbs.
Heating surface, tubes	1,467.39 sq. ft.
" " firebox	162.61 "
" " total	1,630.00 "
Grate area	28.00 "
Tubes—No. 188; outside diameter	2¼ in.
" length	12 ft. 10½ in.
Diameter of driving wheels	79 "
Diameter truck wheels	42 "
Tank capacity, water	3,500 gals.
Tank capacity, coal	7 tons
Engine, wheel base	25 ft. 2 in.
Engine rigid wheel base	8 ft. 3 in.
Total wheel base engine and tender	48 ft. 9 in.
Total length of engine and tender over couplers	57 ft. 3¾ in.
Weight of engine	126,900 lbs.
Weight on driving wheels	83,100 "
Tractive power	16,315 "

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 5.09$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 7.78$$

$$\frac{\text{Tractive effort x diam. drivers}}{\text{Heating surface}} = 7.91$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 58.21$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = .10$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 51.00$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 77.85$$

$$\frac{\text{Volume of two cylinders}}{\text{Heating surface}} = 7.66 \text{ cu. ft.} \div 212.79$$

$$\frac{\text{Grate area}}{\text{Vol. of two cylinders}} = 3.65$$

Train Accidents in the United States in June.[1]

rc, 1st, Lake Shore & Michigan Southern, Sandusky, Ohio, westbound fast mail train No. 17 ran into the rear of a preceding freight, making a bad wreck, blocking all the main tracks. The engineman, fireman and three mail clerks were injured. It is said that the mail train disregarded a caution signal or slow order.

bc, 1st, 5 a. m., Southern Railway, Bryan, Ala., butting collision between freight trains 73 and 84; one fireman killed; one engineman and three other trainmen injured, the engineman fatally.

unx, 1st, Northern Alabama, Bear Creek, Ala., a passenger train was derailed and the engine and two cars fell down a high bank. The fireman was killed and three other trainmen were injured.

xc, 2d, Atlantic Coast Line, Newberry, Fla., collision of passenger trains, killing one engineman and injuring one fireman. There was a dense fog at the time.

dn, 2d, 2 p. m., Pennsylvania road, Marion, N. J., the eastbound St. Louis express train, second section, ran upon the draw of the bridge at Hackensack river when the bridge was partly open, the rails being about 3 ft. out of line. The speed of the train at the time was about 35 miles an hour. The engine ran the whole length of the draw span on the sleepers and then fell into the river; the tender and the next three cars, one a dining car, all badly damaged, lodged on the draw. The only person seriously injured was the engineman, who jumped out of the cab and sustained a sprained ankle. The dining car, which was empty, was partly overturned and the trucks of all three cars on the draw were slewed or bunched. The first sleeping car was occupied by only three passengers and the porter, and the second by six passengers and two employees. The draw appears to have been opened after the engine passed the home signal (at clear), which is 1,725 ft. west of the draw. The distant signal is 2,931 ft. farther west. The signals are automatic semaphores, on signal bridges, but controlled by the bridge tender. At the home signal there is a "smash signal," worked manually by a wire from the cabin on the draw, which, when the draw is to be opened, is let down to a position in which it will be struck by the engine if a train passes it. This signal is a big round disk.

2d, Northern Pacific, Laurel, Mont., a mixed train was derailed while running at good speed and a man riding on a platform car was killed. Eight cars were ditched.

bc, 3d, 9 p. m., Chicago & North-Western, California Junction, Ia., butting collision between passenger train No. 6 and an empty engine, badly damaging both engines and four passenger cars. One engineman was killed and one mail clerk injured.

xc, 3d, Cumberland Valley, Chambersburg, Pa., a freight train ran over a misplaced switch and into the rear of a preceding freight, damaging the caboose and several cars. One trainman was killed and two others were injured, one of them fatally.

unx, 3d, Chicago, St. Paul, Minneapolis & Omaha, Superior Junction, Wis., the engine and first car of a passenger train were derailed at a switch; fireman killed, two other trainmen injured.

unx, 4th, Central of Georgia, Walden, Ga., a freight car was derailed and four men stealing a ride were badly injured, one of them fatally.

bc, 5th, Grand Rapids & Indiana, Cadillac, Mich., butting collision between a wrecking train and a work train, wrecking both engines and several cars. Two employees were killed and several others slightly injured.

†rc, 6th, Atlanta, Ga., an excursion train of the Atlanta & West Point, consisting of 16 cars, all filled, approaching the Union Station, was run into at the rear by a passenger train of the Central of Georgia and the rear car of the excursion train was wrecked. One passenger was killed and six seriously injured, two of them probably fatally.

bc, 6th, Colorado Midland, Boyer, Col., butting collision between a passenger train and a freight, making a bad wreck. One engineman and one fireman were killed.

*xc, 7th, Pennsylvania road, Lancaster, Pa., collision between a passenger train and a work train, badly damaging both engines. Two cars of the work train took fire and were burnt up. Three trainmen were injured.

unx, 7th, Illinois Central, Benton, Ill., a mixed train was derailed and the engine fell down a bank, killing the engineman.

xc, 8th, 3 a. m., St. Louis, Iron Mountain & Southern, Mengo, Mo., a northbound passenger train entering a side track was run into by a southbound passenger train, badly damaging several cars. One fireman was killed and 22 passengers were injured.

unx, 8th, Chicago, Rock Island & Pacific, Jennings, Kan., eastbound passenger train No. 6 was derailed and 18 passengers were injured.

unf, 9th, Buffalo, Rochester & Pittsburg, Gayton, N. Y., a freight train was derailed by a tree which had blown down and lodged on the track, and 15 cars were ditched. The fireman was killed and the engineman injured.

unx, 9th, Georgia Railroad, Mesena, Ga., a passenger train was derailed; engineman and fireman killed, five passengers injured.

unx, 10th, Atchison, Topeka & Santa Fe, Gibbs, Mo., a freight train was derailed and several cars were ditched; the conductor was killed.

bc, 11th, Long Island road, Manhassett, N. Y., butting collision between a passenger train and an empty engine; two trainmen injured.

†dn, 11th, Central of N. J., Eatontown, N. J., a northbound passenger train was derailed at a misplaced switch and the engine and two cars were overturned. One passenger was killed and 23 injured, 21 of them only slightly.

xc, 12th, Chesapeake & Ohio, Masseys, Va., a collision between a passenger train and a car of lumber which had escaped control and was running down grade at high speed. The engineman, fireman and two other persons were injured.

eq, 12th, Minneapolis, St. Paul & Sault Ste. Marie, Harvey, N. D., a heavily loaded passenger train was derailed by the breaking of an axle, and the engine was ditched. Several cars were overturned and many passengers were injured, but, according to the reports, nearly all of the injuries were slight.

bc, 13th, Northern Pacific, Trazee, Minn., butting collision between a passenger train and a freight. One person was killed and 16 were injured.

xc, 13th, Seaboard Air Line, Limerick, Ga., collision between a northbound passenger train and a southbound freight; two passengers and two trainmen injured.

bc, 14th, Chicago, Rock Island & Pacific, Marine, Ia., butting collision of fast passenger trains; eight passengers and three trainmen injured.

xc, 14th, Atlantic Coast Line, Yemassee, S. C., collision between a passenger train and a freight; four persons injured.

†14th, Atchison, Topeka & Santa Fe, Point San Pablo, Cal., a train

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

consisting of two passenger cars and two freight cars carrying workmen to a brickyard was derailed at a defective switch; three workmen were killed and seven or more injured.

unx, 14th, Pennsylvania Lines, Elba, Ohio, a passenger train was derailed and the engine and baggage car fell down a bank. The smoking car was overturned, but all of the occupants escaped with slight injuries. The engineman and fireman were seriously injured.

dn, 15th, Norfolk & Western, Wakefield, Va., eastbound passenger train No. 4 was derailed at a derailing switch approaching a crossing, and the engine and first two cars were wrecked. The fireman and a mail clerk were injured.

rc, 16th, Southern Pacific, Reno, Nev., a freight train ran over a misplaced switch and into the rear of another freight train, damaging several cars. A fireman was killed.

bc, 17th, 11 p. m., Nashville, Chattanooga & St. Louis, Whiteside, Tenn., butting collision between passenger train No. 11 of the Southern Railway and train No. 17 of the Nashville, Chattanooga & St. Louis, wrecking both engines and several freight cars. A tramp was killed and one engineman and one passenger were injured.

*xc, 17th, Cleveland, Cincinnati, Chicago & St. Louis, Mix, Ohio, a freight train broke in two and the rear portion afterward ran into the forward one, damaging several cars and exploding a car of naphtha. The wreck took fire from the naphtha and was burnt up, together with a number of trees on both sides of the road.

bc, 18th, 4 a. m., Baltimore & Ohio, West Wheeling, Ohio, butting collision between a special train, consisting of an engine and one officers' car and a freight train; three trainmen were injured.

bc, 19th, Louisville & Nashville, Middlesboro, Ky., butting collision between passenger train No. 26 and freight train No. 21. Seven passengers and two trainmen were injured.

eq, 19th, Southern Pacific, Reno, Nev., a freight train was derailed by the breaking of a wheel and several cars were piled up in a bad wreck. Four tramps were killed and two others injured.

rc, 20th, Central Vermont, Mansfield, Conn., rear collision of freight trains. One brakeman killed.

20th, Rutland road, East Clarendon, Vt., collision between a passenger train and a carload of wheat which had escaped control while being switched and was running at high speed down grade. The passenger train had been, or nearly, or quite, brought to a stand. The engineman was killed.

xc, 21st, Atlantic Coast Line, Ahoskie, N. C., collision of freight trains, one of which was switching. Two trainmen were killed and the conductor and a trespasser were injured.

unx, 22d, Chicago & North-Western, Peebles, Wis., a work train running backward was derailed and the caboose and a car loaded with rails were wrecked, the rails penetrating the caboose. A number of workmen in the caboose were injured, one of them fatally.

bc, 23d, Seymore, Ala., butting collision between a westbound freight train of the Louisville & Nashville and an eastbound freight train of the Southern Railway on the joint track used by both roads, badly damaging both engines. One engineman was killed and four other trainmen were injured.

24th, Southern Railway, Sayreton, Ala., the tender of the locomotive of a freight train was derailed, and, with the engine and several cars, was wrecked. One brakeman was killed and three other trainmen were injured.

unx, 24th, Atchison, Topeka & Santa Fe, Hardin, Mo., a freight train was derailed and the engine was overturned; fireman killed, engineman injured.

xc, 25th, Lake Shore & Michigan Southern, Adrian, Mich., a passenger train ran over a misplaced switch and into a standing passenger train. Three trainmen and six passengers were injured.

dn, 25th, Atlantic Coast Line, Tampa, Fla., a switching engine moving backward ran off the end of the track at an open draw and fell into Hillsborough river. One trainman went down with the engine and was killed.

unx, 25th, Chicago, Great Western, Gladbrook, Ia., passenger train No. 6 was derailed, and, running across a bridge on the sleepers, was overturned, four passenger cars falling down a bank. Six passengers were injured.

unx, 25th, Norfolk & Western, Limeton, Va., a freight train was derailed and wrecked, and the engineman and fireman were killed.

xc, 26th, 10 p. m., Atlantic Coast Line, Goldsboro, N. C., a car, in bad order, attached to the rear end of a freight train, broke away when the train stopped at the station and ran back down grade some distance into the head of passenger train No. 42. The engineman and fireman were injured.

†eq, 26th, Grand Rapids & Indiana, Long Lake, Mich., a freight car in a mixed train was derailed in consequence of some defect in the truck; one passenger and one trainman injured, the passenger fatally.

unx, 27th, Sierra Railway, Jamestown, Cal., a car in a mixed train was derailed on a curve and was overturned. This car contained dynamite, which exploded, and wrecked not only the cars in the train, but a factory nearby. Window-glass was broken at Milton, about 20 miles away. Two brakemen were killed, one of them being blown to atoms; and the conductor and one passenger were injured.

*xc, 29th, 10 p. m., Atlantic Coast Line, Martin, Fla., a freight train, with one engine at the front and another at the rear, broke in two while ascending a steep grade, and soon afterward two or three of the rear cars were crushed by the pushing engine. Seven loaded cars took fire and were burnt up. The engineman and a flagman were killed and their bodies were nearly destroyed by fire.

unf, 29th, Chicago, Milwaukee & St. Paul, Canton, Ia., a passenger train was derailed at a washout and two trainmen were injured.

xc, 30th, 1 a. m., Chicago, Burlington & Quincy, Ipava, Ia., a northbound passenger train collided with a string of five freight cars which had been blown by a high wind from a siding to the main track. The fireman and several passengers were injured, the fireman fatally.

30th, Delaware, Lackawanna & Western, Chadwicks, N. Y., the rear car of a southbound passenger train was derailed at a switch, and, with the other two cars, was wrecked against freight cars on a side track. Seventeen passengers and one trainman were injured, two of the passengers probably fatally.

unx, 30th, Southern Railway, Oakman, Ala., the engine of a local freight train was derailed, and a brakeman riding in the cab was killed. The fireman was badly scalded.

Wear of Wheel Tires on Locomotives with Inside and Outside Cylinders.

A very interesting investigation into the effect of cylinder location on the wear of locomotive driving wheel tires has recently been concluded and reported upon in the April issue of the Bulletin of the International Railway Congress by M. O. Busse, Locomotive and Rolling Stock Superintendent for the Danish State Railways. For the purposes of the inquiry two classes of locomotives were chosen, known as classes C and K. They are of the eight-wheeled 4-4-0 type with a leading bogie truck. The two classes are practically identical in all weights and measurements and general design except that class C has inside cylinders while class K has outside, and,

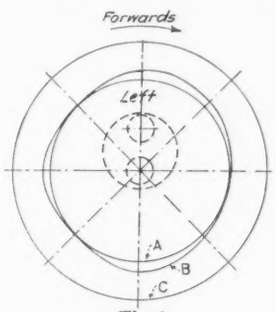


Fig. 1.

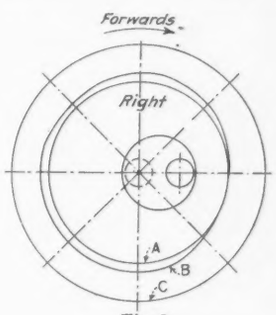


Fig. 2.

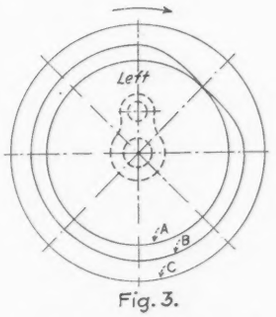


Fig. 3.

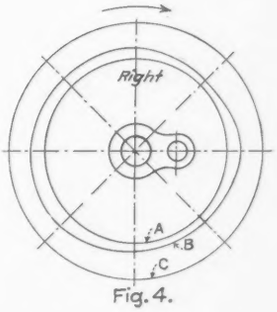


Fig. 4.

A—After being turned up again the first time.
B—Wear observed at first general overhaul.
C—When first put to work.

Wear of Tires on Locomotives.

during the test they were all used in express passenger service. The cylinders are 17 in. in diameter with a piston stroke of 24 in. The total weight on the drivers is 57,320 lbs. The driving wheels are 6 ft. 1½ in. in diameter and the heating surface is 1,049.73 sq. ft. in class C, and 1,017.55 sq. ft. in class K—certainly not difference enough to affect the wear of the tires. The rigid wheel base is 8 ft. 6⅜ in.

The tires of all these locomotives were supplied by Krupp to the same specification. The wear determined by the successive measurements and the means found have served for drawing the illustrations which show how the tires of the left wheels and of the right wheels respectively have become worn to an oval shape. The greatest average wear is 0.20866 and 0.20473 inch for the two types of locomotive respectively. The thickness of the tire was reduced by

wear and by being turned, 0.27559 inch in both cases; from this point of view there is thus no difference between the two locomotives.

But matters are very different if the mileage is taken into consideration; for each C locomotive ran 55,951 miles on the average, whereas the K locomotive only averaged about 28,034 miles. That is a difference of about 93 per cent. in favor of the C locomotive. Thus the average mileage per $^1/_{16}$ in. of wear is 42,592 in the case of the class C engines and only 22,553 in that of the K class.

According to the regulations of the Danish Railways the tire must be at least $1^3/_{16}$ in. thick at the time of the last turning. From the data already secured it is estimated that seven turnings can be obtained from which the life of the class C tires will be 447,768 miles and those of class K 232,263 miles.

In discussing the matter of the relation of locomotive repairs to tire wear, an element of Danish practice is brought out that does not necessarily obtain in America. M. Busse says that each time the tires are turned up the locomotive has to be overhauled; consequently, for a given mileage, locomotives K have to be taken to the shops twice as often as locomotives C.

He also claims that the cost of maintenance of the boiler depends chiefly on the mileage, but the cost of repairing the other parts of the locomotive and the tender is nearly the same for a locomotive which has run 29,034 miles since the last general overhaul as for one which has run 55,971 miles. Now as the latter items represent 55 per cent. of the total cost, it is evidently an advantage if the locomotives do a long mileage between repairs.

M. Busse then goes on to cite some of the advantages claimed for the inside cylinders, not the least of which is to the effect that as they have to be taken less frequently to the shops they are consequently more rarely put out of work, and hence the same number of locomotives can deal with more traffic. It follows that locomotives with inside cylinders are much more profitable than locomotives with outside cylinders. The fact absolutely confirms the correctness of the claim with reference to the wear of the tires.

Again, the frame plates with the inside arrangement have lower stresses to withstand, and as the two cylinders cast in one piece form the front cross-stay, it was possible to reduce the weight of the frame materially. The thickness of the plate used for the frame plates has been reduced from $1^3/_{16}$ to $^{21}/_{32}$ inch, the bottom of the smokebox has been made materially thinner, and it was possible to eliminate part of the cross-stays. In this way the weight has been reduced by about 3,570 lbs. Using a crank axle increases the prime cost of the set of drivers about $950. Otherwise there is hardly any appreciable difference between the cost of building locomotives of the two types, and it may be assumed, other conditions being equal, that a locomotive of the class C will cost about $880 more than one of class K.

The article concludes with a repetition of a previous statement to the effect that the engines with inside cylinders run on the average 93 per cent. further between two general overhauls than those with outside cylinders. Hence, it is argued that this extra cost is well worth incurring. And it is regretted that the advantages of having inside cylinders were not recognized sooner; otherwise a considerable saving in maintenance would have been effected. However, the fact will fortunately lead to the adoption of the four-cylinder system, which makes it possible to have a very powerful locomotive with moderate wear of tires and moderate cost of maintenance.

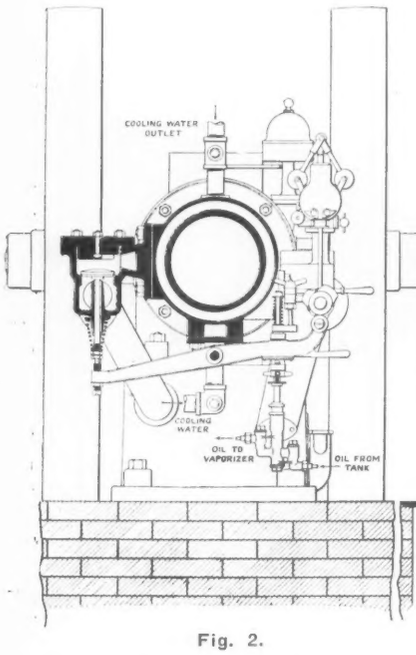


Fig. 2.

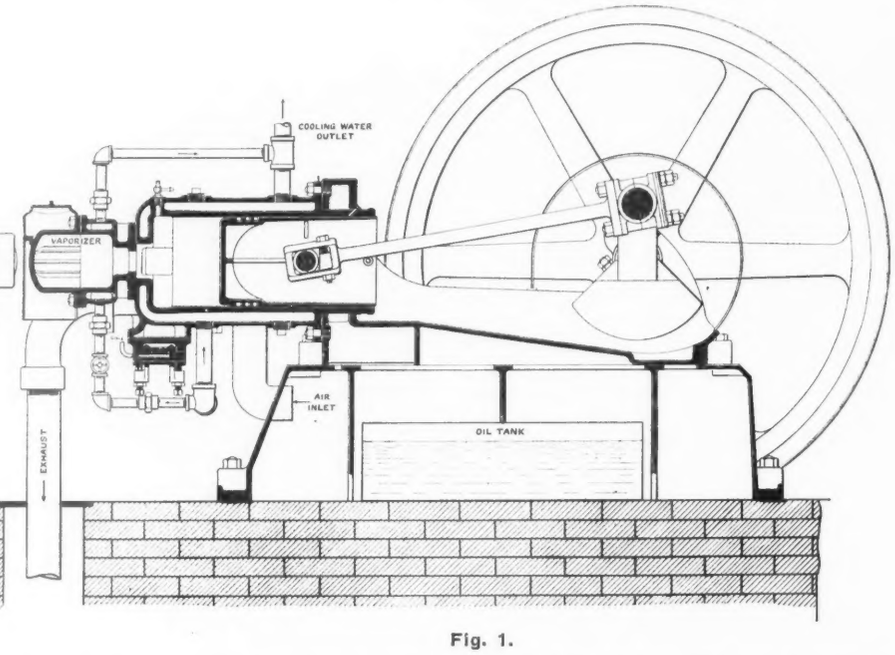


Fig. 1.

The "Hornsby-Akroyd" Kerosene and Fuel Oil Engine.

Like most small and medium-size internal combustion engines, the "Hornsby-Akroyd" operates on the Beau de Rochas or four-stroke cycle, in which the fuel is first aspirated; secondly, compressed; thirdly, exploded, and fourth, expelled from the cylinder. This engine operates on kerosene or fuel oil, and is distinguished from engines operating on gas or volatile fluids, such as gasoline or naphtha by the entire absence of electric batteries and other igniting mechanism. The fuel is gasified in the vaporizer, which is a cast-iron chamber separated from the main cylinder by a narrow neck, as shown in Fig. 1. By the heat of successive explosions this vaporizer is maintained at a dull red heat, sufficient to vaporize the entering oil. The oil is supplied to the vaporizer by a positively driven oil pump, which maintains a pressure in the pipe leading to the vaporizer. A small check-valve is placed in this pipe near the vaporizer, so that the shock of the explosion does not reach the oil pump. If the engine should speed up the governor opens a small by-pass valve, which allows part or all of the oil to return to the tank in the bed-plate of the engine, instead of entering the vaporizer. See Figs. 3 and 4.

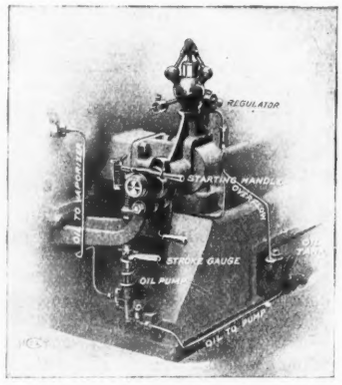


Fig. 3.

During the time the oil is entering the vaporizer the charge of air is drawn into the main cylinder by the outgoing piston. On its return stroke the piston forces the air into the vaporizer, where it mixes with the vaporized oil, thus forming a combustible charge. The heat of compression, together with that of the vaporizer, is sufficient to ignite the mixture just at the time the piston is passing the inner dead center.

The energy produced by this combustion is transferred to the piston and through the connecting rod and crank-shaft to the machinery which the engine drives. On returning the piston expels the burned gases and then commences the cycle over again by sucking in a fresh charge of air while the pump injects a new supply of oil into the vaporizer.

In starting up the engine the vaporizer must be heated by means of a kerosene or gas burner, this operation requiring about 15 or 20 minutes. For the first two or three revolutions compressed air, kept stored for the purpose in a small receiver, is used. The smaller

engines can be started by hand, compressed air being required for the larger sizes only.

As will be seen from the sectional views of the engine (Figs. 1, 2 and 5) the cylinder, air and exhaust valve-box and that part of the vaporizer nearest the cylinder, are all water-cooled. In engines of 100 h.p. and over the piston is also water-cooled, the water being circulated under pressure.

All boiler plants are more or less dangerous and troublesome; for this reason, the internal combustion engine has come into public favor, and this factor taken in combination with their high economy and extreme simplicity is winning for them the first place among all classes of prime movers. We give herewith a record of tests of a

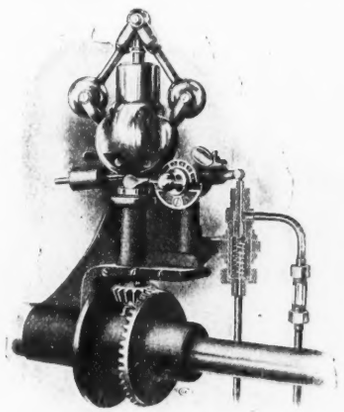


Fig. 4.

25-h.p. "Hornsby-Akroyd" oil engine taken from "Gas and Petroleum Engines" by Robinson:

Power or load factor	Full	Two-thirds	One-third	No load	Max. load
Duration of trials, hours	3	3	2	1	¼
Revolutions per minute (mean)	202.6	202.4	203	201.5	203
Explosions per minute (mean)	101.3	101.2	100	100.7	101.5
Mean effective pressure (net) lb. per square inch	45.4 43.4	31.2	18.3	6	..
Indicated horse-power	32.3 31	22.4	13.1	4.28	..
Brake horse-power	26.74	17.96	9	0	39
Mechanical efficiency, per cent	82.4 86	80	69	..	..
Oil used in engine—					
Per indicated horse-power-hr., lb.	0.61 0.63	0.74	0.91	1.34	..
Per brake horse-power-hour, lb.	0.74	0.91	1.3	..	..

The low price of suitable oils now on the market in all parts of this country has created a widespread interest and demand for engines capable of utilizing these oils. The "Hornsby-Akroyd" has demonstrated its ability to give with such oils as fuel the same service as a steam engine. Probably the most interesting installation of these or any

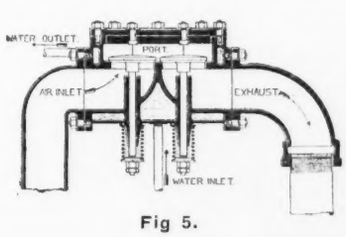


Fig 5.

other oil engines is that now being made for the Baldwin Locomotive Works, Philadelphia, Pa. This installation will develop 4,000 B.h.p., and is divided into 125 and 250 h.p. units. Some of these are direct connected to generators and some to air compressors, while others are used to drive general machinery by belt. In Fig. 6 is shown one of these single cylinder 125-h.p. engines. A twin-cylinder engine is shown in Fig. 7. The following figures on the total cost of operation of a 125-h.p. "Hornsby-Akroyd" oil engine give an idea of the economy to be effected by the use of these engines:

Actual Cost of Power, Per Brake Horse-power Per Year, Based on 300 Working days of 10 Hours Each.

Fuel or crude oil at 3 cents per gallon	$9.27
Lubricating oil, waste or supplies	3.30
Attendance	5.00
Interest on the investment, depreciation, etc., at 12 per cent	7.80
Total cost, per b.h.p.-year, of 3,000 b.h.p.-hours	$25.37

also a comparison of the cost of operation of a 50-h.p. oil engine plant and a 50-h.p. steam plant. These plants are installed at the works of the Luna Lead Co., Deming, N. Mex.

Cost of Operation.

Steam.

Coal consumption on 1,200 h.p.-hours per 24 hours (50 indicated h.p. to produce 40 brake h.p.) at 5 lb. per h.p.hour, 6,000 lb. at $5 per ton	$15.00
Attendance—	
2 engine tenders (12-hour shift)	8.00
2 boiler men	3.00
Oil, waste and supplies other than fuel	.20
Repairs	.20
Interest on power plant at 5 per cent	.30
Cost per 24 hours	$26.70

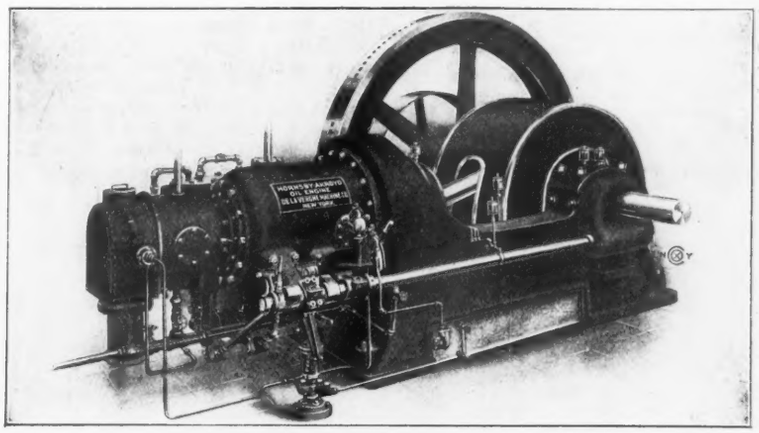


Fig. 6

Crude Oil.

Crude oil consumption 106 gallons per 24 hours (actual results) at 2½ cents per gallon (in tank car lots)	$2.65
Attendance—	
2 engine tenders (12-hour shift)	8.00
1 helper (1 shift only)	1.50
Oil, waste and supplies other than fuel	.20
Repairs	.60
Interest on power plant at 5 per cent	.71
Cost per 24 hours	$13.66

The saving per day of crude oil over steam is $13.04, amounting in a working year of 350 days to $4,564, which is $1,400 more than the extra cost of the oil-engine plant.

Cost of oil engine power per brake horse-power per year of 350 days (24 hours each)	$119.53
Cost of steam power per brake horse-power per year of 350 days (24 hours each)	233.63

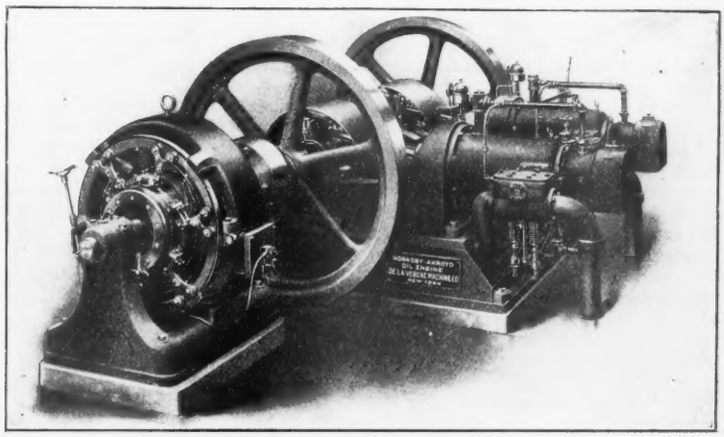


Fig. 7.

This comparison was made by Mr. Wm. Magenau, superintendent of the plant, and appeared in the Mining and Scientific Press of May 26, 1906. From the fact that over 14,000 oil engines of the "Hornsby-Akroyd" type alone are in operation it will be seen that the use of this class of engines is very wide. They are being installed in direct competition with steam engines, which in many cases are discarded in their favor, and are being used in all classes of work, in mines, manufactories, wireless telegraph stations, central stations, lighthouses, pumping plants and in many places where a few years ago only steam engines would have been considered.

The "Hornsby-Akroyd" engines are made and sold by the De Lavergne Refrigerating Company, 138th street, New York.

Form 31 on the Northern Pacific.

The Northern Pacific method of handling the train order Form 31 differs from the usual practice and Mr. H. A. Dalby, an experienced despatcher, and formerly a despatcher on that road, thinks it far superior. The order is made "complete" immediately on its repetition. The operator prepares three copies of a clearance card (or more if there is more than one engineman on the train), one for the conductor, one for each engineman and one for himself. On it he writes the number of each order to be delivered. As the train approaches or, if stopped at his station, when it reports ready to leave, he calls the despatcher and says (for instance), "Clear 3d 53 on 31 Nos. 18 and 25 and 19 No. 27." The despatcher satisfies himself that these are the proper orders and repeats the same thing to the operator, adding "O. K." and signing the superintendent's initials. This he records in his order book. The operator is then responsible for obtaining the conductor's signature, but it is not sent to the despatcher.

The advantages of this method are that it is not necessary for the operator to hold the conductor in the office while he sends his signature to the despatcher, waiting for the latter to write the conductor's name and the time on each order, then writing "complete" and the time on each copy himself. All this the operator has done beforehand. The despatcher does, of course, look to see that each order is included in the clearance, but he does not make the notations usually required, and thus much time is saved.

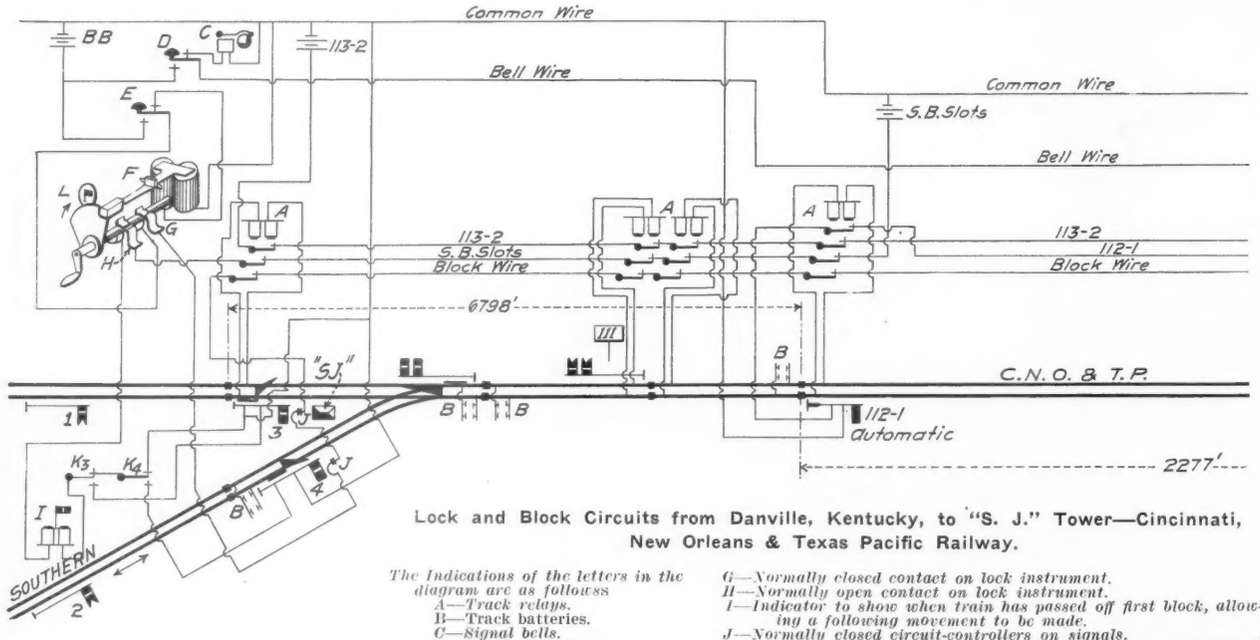
A train must not leave a station where "stop" has been displayed without a clearance card showing the form (19 or 31) and numbers of the orders delivered; or, if no orders, showing that there are none. If there are no 31 orders the operator may deliver "19" orders without consulting the despatcher, but if there are any of Form 31 he must check the numbers of all, as indicated in the above example. If the wire is in trouble he may deliver all orders he may have for the train in the usual way, and if there are any on the 31 form, he makes a note of the wire failure, which the conductor will accept in lieu of the despatcher's "O.K." This avoids holding the train to get "complete," which is one of the requirements of the Standard Code, and sometimes a source of delay.

Practically, the conductor's signature is obtained just as surely, as the operator is held rigidly responsible for it, and the record in the despatcher's office is just as complete, his clearance showing the number of every order delivered. Much time is saved in the transaction between the operator and the conductor and also by the despatcher in being relieved of writing the signature and the time of each "complete."

In answer to inquiries in the Swiss Parliament, the authorities said that so far there has been a satisfactory passenger traffic through the Simplon tunnel, due partly to the Milan exhibition. The arrangements for connections with railroads to Mediterranean ports for freight traffic are still incomplete, and of three freight trains daily, provided at first, two had been taken off and the remaining one consisted usually of only two or three cars. Rumors having been published that the parallel tunnel in which the second track is to be laid, had caved in and destroyed the channel which carries off the hot water, assurances are given that though there has been some crumbling of the work, nothing more serious has occurred than to cause an investigation to determine whether this tunnel should not have its masonry lining built at once, instead of waiting until the second track is laid, as was originally intended.

Combined Manual and Automatic Block Signaling on the C., N. O. & T. P.

Between Danville, Ky., and the junction of the Southern Railway, about 3½ miles north of Danville, the road of the Cincinnati, New Orleans & Texas Pacific, single track, is now signaled by the controlled manual system for opposing trains and by track circuit signals for following trains—that is, for the protection from each other of trains moving in the same direction. For trains starting northward from Danville or southward from the north end of the section ("S J") the signals are semi-automatic, but there is an intermediate signal for northbound trains and another for southbound which are purely automatic. These intermediate signals do not protect a train from other trains moving in the opposite direction, and the practice with them is precisely the same as it would be with automatic signals on a double-track line; that is to say, a train finding a signal standing against it simply comes to a stop and then at once proceeds under control. It does not flag ahead, as is necessary on single track lines which have only automatic signals.



Lock and Block Circuits from Danville, Kentucky, to "S. J." Tower—Cincinnati, New Orleans & Texas Pacific Railway.

The Indications of the letters in the diagram are as follows
A—Track relays.
B—Track batteries.
C—Signal bells.
D—Bell push-buttons.
E—Lock push-buttons.
F—Lock instruments.
G—Normally closed contact on lock instrument.
H—Normally open contact on lock instrument.
I—Indicator to show when train has passed off first block, allowing a following movement to be made.
J—Normally closed circuit-controllers on signals.
K—Two-way, back and front circuit-controllers on signal levers.
L—Indicators to show when unlock is received.
B B—Lock and bell battery.

The arrangement of the signals and of the electrical connections is shown in the drawing. The block wire, connecting the two block stations, is controlled by the track relays of all the track sections between the two stations so that neither of the two signalmen can give a clear signal until the whole of the three-mile section is free of trains. All of the signal and lock instruments also control the block wire, so that it is never possible for one station to unlock the other until all apparatus is in normal position.

Either signalman, after having had his signal levers unlocked by the man at the far end of the section, may leave them unlocked as long as he may find it necessary or desirable, and thus may permit any number of trains to follow one another, without further mechanical action on the part of the other signalman. There are two entrances to the block from the north end and three entrances at the south end. After each movement into the block the operator, as soon as the train has passed the tower, signals by bell code to the other operator, telling the nature of the train and to which road it belongs. This signal is repeated. The operator at the exit end of the block then sets his switches properly.

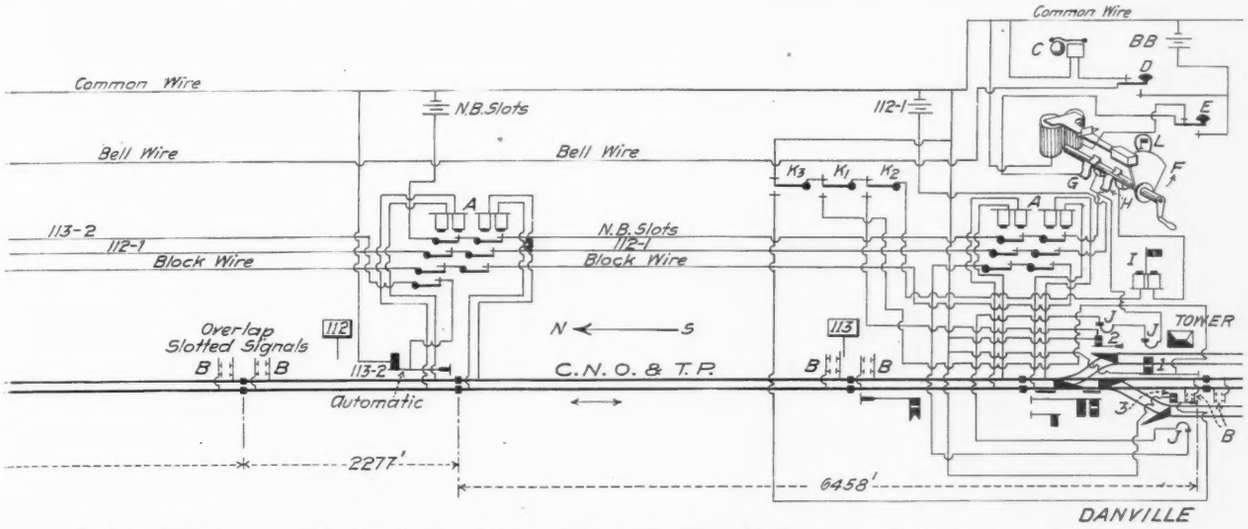
In each tower there is an indicator, (I) which shows the towerman the instant the slotted signal is cleared by the train, so that

he can give a following train a clear signal without delay. The lock instrument (F) used for the "Lock and Block" is similar to that shown in Section No. 11 of the Union Switch & Signal Co.'s catalogue, page 28, No. 6. The unlock having been received, and handle turned, the indicator is held clear mechanically, and this shows the operator that he has possession of the block. All circuits except the track and intermediate for automatic signals are normally open.

To explain the operation of the apparatus more clearly we may follow the movement of a train from "S J" Tower to Danville, with which the procedure would be as follows: "S J" will signal Danville on bell C that he desires the block. If agreeable to Danville, he will answer O. K. on bell C and unlock the lock instrument F at "S J" by pressing lock push button E. On pressing this button the path of Danville's lock current is as follows: From battery through front contact of push button E to normal closed contact G on lock instrument F; thence through three normally closed circuit controllers J on signals Nos. 1, 2 and 3; through contact points on all track relays A between Danville and "S J"; through normally closed circuit controllers J on signals Nos. 3 and 4 at "S J"; through normally closed contact G on lock instrument F at "S J," and through normal closed back contact on push button E, thus charging the coils on lock instrument F, unlocking F; and thence back to the common return wire. When lock instrument F at "S J" is unlocked, indicator L will show clear and "S J" will turn the lever on the lock instrument. This opens the block wire at G and closes the southbound slots circuit through contact H. If the movement is of a Southern train, "S J" will pull lever No. 4. The lifting of the latch of this lever shunts the slot circuit (through K4) into the slots on signal No. 4. After signal No. 4 is cleared, distant signal No. 2 can be cleared. As soon as the train has passed into the block, "S J" signals Danville this fact on bell C and Danville answers that he understands.

If, now, a train appears at "S J" on the CNO&TP "S J" will reverse his levers Nos. 2 and 4, and set the switches for the CNO&TP train, leaving his lock instrument reversed and thus holding possession of the block. As soon as the Southern train has cleared the overlap of the slotted signal, which is in the center of the block, "S J's" indicator I on the slot battery will clear, so that when the latch of the lever for signal No. 3 is lifted it will shunt the battery into the slot on signal No. 3, through circuit closer K3; so that the signal can be cleared, allowing the CNO&TP train to proceed. When this train passes "S J" the towerman will signal this fact to Danville. This procedure can be kept up indefinitely, as long as the train movements continue in same direction. If, in the example above, the Southern train is not clear of the block at Danville when the CNO&TP train reaches signal No. 112-1, the engineman will stop the train, wait one minute and proceed under control to Danville.

The block signals at each end of the block are absolute signals and a following train is not allowed to pass them until the train ahead has passed the center of block, whereas the automatic signals are "permissive" signals, or, as they are styled, "one minute blocks." The intermediate signals are so located, taking into consideration the grade, that for a movement in either direction, if a second train enters the block immediately after the first train has passed the overlap, the first train will go far enough to restore the intermediate signal to clear before the second train has reached it. Distant signals are not provided for the intermediate signals, but each is so controlled that it has an overlap of 2,277 ft.



Lock and Block on the Cincinnati, New Orleans & Texas Pacific.—Continuation of drawing on preceding page.

Illinois Central Operating Officers' Meeting.

A meeting of the general and division operating officers of the Illinois Central was held in Chicago last week. This is the second such meeting that has been held, the first occurring two years ago. It is the intention to hold them annually in future. There were about 100 in attendance, representing the traffic, accounting and operating departments, the latter including the machinery and engineering departments. The meeting lasted throughout the week; that is, from Monday to Friday inclusive. It was presided over by General Manager Rawn, and addresses were made by the general officers of the different departments represented. Operating questions of interest to each of the departments were discussed.

The next important topic considered was the monthly allotment of expenditures and the daily check of expenses in the maintenance of way and machinery departments. This practice was inaugurated two years ago by General Manager Rawn, and has proved most satisfactory and successful. It is said that at the present time the expenses average within 2 per cent. of the allotment. By means of the daily check it is known each day what the previous day's expenses have been.

A number of other interesting topics were considered. For the machinery department, thorough discussion was given to the matter of more uniform inspection of locomotives at all division points, and also to the light weighing and re-stenciling of freight equipment. A method was outlined for periodical weighing and stenciling of these cars, each six months when possible, but not to exceed one year.

Loss and damage to freight was fully discussed and a method outlined for arriving more closely at the causes responsible for such claims and the remedies therefor. Another subject was the uniform system of settlement of switching accounts and for checking switching performances at the different points of the system.

Canadian Railroad Notes.

OTTAWA, July 23.—Applications of the Erie & Ontario Power Company for the approval of the lines it purposes building in the Niagara district have been laid before the Minister of Railways for approval but were held over until the company states how much water it wishes to utilize.

As securities have been issued upon the Canadian Northern's terminal lands at Winnipeg, it is impossible for the National Transcontinental Railway Commission to acquire a satisfactory title to this property, which it is desired to utilize for the Grand Trunk Pacific. An agreement has been reached whereby the Winnipeg terminals will be owned jointly by the government and by the Canadian Northern, and will be used jointly by the latter and by the new transcontinental road.

Contracts were recently let for the new $300,000 Grand Trunk building at Montreal. It is to be ten stories high. The first two stories will be of gray sandstone and the others of semi-glazed terra cotta. The two first floors will be occupied by the company's express business.

There are numerous reports that the Canadian Northern

has bought the Qu'Appelle, Long Lake & Saskatchewan road, giving it access to Regina and shutting the Canadian Pacific out of Prince Albert.

Negotiations are proceeding between the Grand Trunk Pacific and Rhodes, Curry & Co., of Amherst, N. S., for 2,500 cars for the new transcontinental railroad.

The Railway Commissioners have issued an order in response to the representatives of Chatham, Windsor and Walkerton manufacturers that railroads operating from Ontario points to the seaboard shall within 90 days submit a new schedule of rates for export and to eastern points. The complainants allege that higher rates are charged them than those in force from Detroit and other Michigan cities. J. A. M.

Lowering the New Haven's Tracks at Mount Vernon.

One of the many problems encountered by the New Haven road, in changing its motive power from steam to electricity, between Woodlawn and Stamford, was the question of minimum overhead clearance. With the exception of four bridges at Mt. Vernon, there was nothing between these points that had a less clearance than 17 ft., consequently 17 ft. was fixed as the minimum, and it was decided to get this at the Mt. Vernon bridges by either raising the bridges or lowering the track. The clearances here varied from 14.7 ft. to 15.2 ft., so that it was necessary to gain from 2.3 ft. to 1.8 ft. On account of grades and excessive damage to adjoining property, raising the bridges was out of the question and the plan of lowering tracks was adopted. The bridges were Third, Fourth and Sixth avenues and South street, three of these bridges being adjacent to the passenger station and the fourth (South street) one-half mile west.

There are four tracks under all the bridges, laid mostly through a rock cut with high-retaining walls on each side. Traffic was turned upon two tracks at a time, and the third track used as a working track, while the fourth was being lowered. All tracks were stone ballasted, so that this had to be removed before excavating could be started. As there was only a maximum depth of two feet of rock to come out drill holes were put on two-foot centers and a channeling machine run along the face of retaining walls. Where the grade was lowered the side retaining walls were underpinned with concrete to protect the bottom of the foundations from frost. Even where the walls rested on rock it was found necessary to remove more or less rotten rock under the walls and replace it with concrete, facing a little up the side to give a finished appearance.

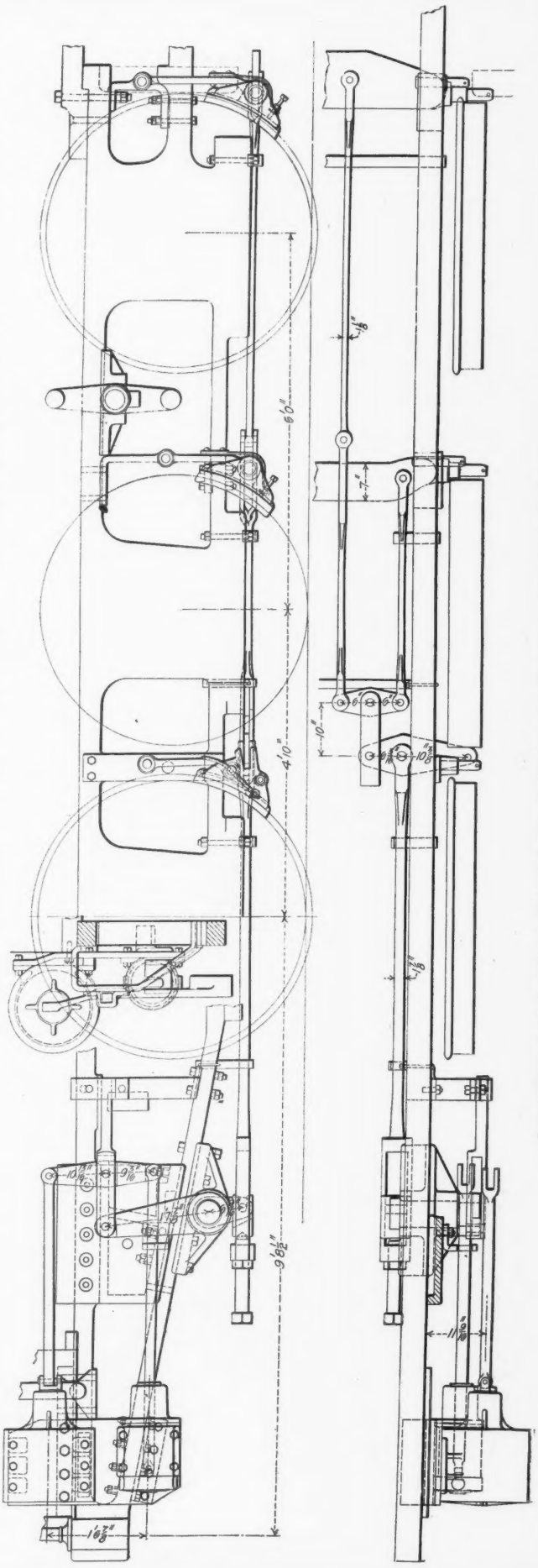
At the passenger station there were 2,500 sq. yds. of granolithic platform torn out and rebuilt to meet the new grade besides lowering 100 ft. of both the east and west bound platform cover sheds. A two-foot overflow sewer was built for 1,000 ft. to take care of water in freshet time. This water has in the past been more or less troublesome to the tracks, so with a depression of 2 ft. more some provision had to be made to take care of it.

Although the yardage was small, still considering all the difficulties met with, the work has been one of the most successfully carried out by the New Haven road in some time. The contract called for its completion in ninety days. The work was started in the middle of March and was finished in contract time by Lathrop & Shea, General Contractors, under the supervision of Mr. F. H. Ellsworth, Division Engineer.

An Auxiliary Driver Brake Cylinder.

In our issue for Oct. 6, 1905, there was shown an auxiliary driver brake cylinder in use on the San Antonio & Aransas Pass Ry. It is intended to be operated by steam and to be used as an emergency device in case of an air pump failure or to hold the brake on while recharging. It consists simply of a cylinder placed tandem with the ordinary brake cylinder.

Another device to accomplish the same purpose has been brought out by the American Brake Co. In this the two cylinders, one for air and the other for steam, are placed one above the other and have their piston rods attached to the opposite ends of the same equalizing lever whose arms are proportioned to the cylinder diameters and pressures used in them respectively. The intermediate connection of this lever is coupled to the end of the brake lever. The result is that whether one or both of these cylinders are thrown into action at the same time, the pressure put upon the shoes is no greater than it would be if but one were in use. The main change involved is the change of leverage of the brake rigging, or a modification of the brake-cylinder diameters; for, with the equalizing lever, the pull upon the upper end of the brake-lever is twice what it would be if the connection were direct from the piston rod. With this exception the foundation rigging remains unchanged, and the leverage and connections to the wheels are of the standard type, as shown by the illustration.



Arrangement of Auxiliary Driver-Brake Cylinder and Rigging—American Brake Co.

GENERAL NEWS SECTION

NOTES.

The Maine Central has lately finished oiling the roadbed on a considerable part of its main line.

The Pennsylvania Lines in Ohio are now selling round trip local tickets on Sundays at 3 cents a mile, or 1½ cents a mile each way.

Chicago newsgatherers now quote the railroad officers of that city as substantially unanimous in their reports of remarkable and healthy activity in all branches of freight traffic.

The narrow gage line of the Denver & Rio Grande from Grand Junction, Colo., to Montrose, 72 miles, and the North Fork branch from Delta, Colo., to Somerset, 43 miles, have been changed to standard gage, beginning July 20.

Fifteen locomotive runners have recently been arrested at Long Island City, N. Y., for violating the board of health rules against the emission of smoke from locomotives. Two men in charge of the big power house at Long Island City have also been arrested.

On July 15 there were in the railroad yards at Jacksonville, Fla., 978 cars of yellow pine lumber awaiting transfer to vessels. The total amount of lumber in the yards was estimated at 35,000,000 ft., the most serious freight congestion ever experienced at that city.

Judge Holt, of the Virginia Corporation Court, has dismissed the suit of the state, which was brought to compel the railroads to comply with the Churchman law, passed at the last session of the legislature, requiring all railroads to sell mileage tickets at 2 cents a mile.

Seventy-five freight agents of the Norfolk & Western met in annual meeting at Norfolk, July 11. The meeting was presided over by General Freight Agent J. R. Ruffin. The men appear to have been mostly the traveling and district solicitors, whose offices are not on the line of the road.

By a vote of 152 to 4, the lower house of the Georgia Legislature has passed a bill to have the State Railroad Commission hereafter elected by vote of the people instead of being appointed. If the bill is passed by the Senate and becomes a law, commissioners will hereafter take office about 12 months after they are elected.

At Louisville, Ky., July 21, J. M. Scott, Chief Train Despatcher of the Louisville & Nashville, was arrested, at the instance of the President of the Order of Railroad Telegraphers, on the charge of discriminating against the members of that order. The charge appears to have been based on the dismissal of certain operators two years ago.

A press despatch from San Francisco says that the freight blockade there is so great that the Southern Pacific has given orders to send no more freight until what is there is unloaded. Seven thousand cars, 20 per cent. of the available equipment of the company, are tied up on sidings near that city. The company has levied storage charges of $7 to $10 a car a day, but without result.

Most or all of the large express companies have applied to the Interstate Commerce Commission for relief from the requirement of the new Federal law that all tariffs of charges shall be filed by August 27. The general manager of the United States Express Company says that, after engaging all available competent men to prepare the tariffs, he thinks that the work cannot be done in less than six months.

The Oregon Railroad & Navigation Company has announced a reduction of 30 cents a ton on wheat and flour sent to Portland for export. This reduction has been made necessary by an advance in the rates by vessel from the Columbia river to foreign ports, and there has also been a reduction, by order of the state railroad commission, on wheat to Puget Sound from points in the state of Washington, which competes with Oregon wheat.

The Baltimore & Ohio, throughout its lines east of the Ohio river, has moved the mail cranes, 1,200 cranes in all, so as to provide a greater clearance between the cranes and the wide engines now used. The change was made at 8 a. m. on July 12. The minimum clearance now is 18 in. On the day of the change the mail cars were all equipped with two arms, the shorter arm being used before 8 o'clock and the longer one after that hour.

The Norfolk & Western has made a rate of $1.50 per ton on coal to Norfolk from the Pocahontas and Tug River districts and $1.60 from Clinch Valley and Thacker districts. These rates are for tons of 2,000 lbs., and are to be granted to all consignees alike. They are 5 cents higher than the "manufacturers' rates" heretofore in force, but 10 cents lower than the general rate. The Chesapeake & Ohio has made a similar change in the rates to Richmond.

Senator LaFollette, of Wisconsin, announces that at the next session of Congress he will renew his efforts to secure the passage of those amendments to the Interstate Commerce law which he offered during the discussion of the Hepburn bill, and which were rejected, and that he will propose others more drastic. He expects the co-operation of the President. The Senator declares that the railroad influence in both houses of Congress during the session just closed has been very strong, so strong that it had an undue influence even on the President.

A committee of the Louisiana Legislature which was instructed to investigate the State Railroad Commission met at Baton Rouge on July 10 and, according to the reports, "disagreed violently." Four of the five members united in a brief report, saying that the commission was doing as well as the most exacting critic could ask; the members were above reproach and were well fitted to perform their duties. The fifth member, who is the chairman, Mr. F. Amedee Tete, makes a minority report, saying that the investigation was no investigation at all. The other four members were so unanimously against him that he had to resort to the extreme measure of adjourning the committee without delay. The majority report gives no hint of the causes for the investigation, but the chairman touches upon two points—the taking of options on a railroad by one of the commissioners and the absence of the commissioners from their headquarters at Baton Rouge. The railroad commissioner who took options is held to have been indiscreet, though he did not fail in his duty as a railroad commissioner. It is declared that the commissioners ought to live in Baton Rouge. At present the business is done mostly by the secretary.

Bequests of F. W. Webb.

F. W. Webb, who died at Bouremouth, England, June 4th, for many years Chief Mechanical Engineer of the London & North-Western Railway, England, left £211,543. He bequeathed £10,000 to found a nursing institution at Crewe; £5,000 to the Benevolent Fund of the Institute of Civil Engineers; £3,000 for St. John the Baptist Mission Church, Crewe; £6,000 for similar purposes in the parish; £2,000 to University College Hospital, preferably for the relief of London & North-Western Railway employees; £2,000 each to Owen's College, Manchester, and University College, Liverpool, for the benefit of the company's employees or their sons; £1,000 to the Men's Convalescent Home at Rhyl; £1,000 to the Devonshire Hospital and Bath Charity; £1,000 to the Manchester Royal Eye Hospital; £1,000 to the Railway Servants' Orphanage, Derby; £1,000 to the Institute of Civil Engineers; £500 to the Royal Albert Asylum for Idiots at Lancaster, and the residue of his estate (about £75,000) for a home for the orphans of employees of the London & North-Western Railway.—*London Times.*

Addition to Power Plant of the Pittsburg Railways Company.

Almost 30,000 additional horse-power in boilers, engines and electrical machinery, to cost more than $300,000, will be added to the Brunot's Island power-house of the Pittsburg Railways Company this year. Large demands for power on this plant have recently been made because of the extension of lines in all directions, both in the Pittsburg and Allegheny and throughout the suburban districts. When the plant on Brunot's Island was built arrangements were made for increasing the capacity to 50,000 h.p. The additional power to be added will bring the plant up to this limit, and it may be further increased in the future. The new equipment contracted for consists of three turbine engines of 7,500 h.p. each and one of 5,000 h.p., making a total of 27,500 h.p. Besides this there will be additional boiler capacity, electric generators, switchboards and wiring. The turbine engines will be the initial installation by this company, and is the first installation of importance in the city. The Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company have the orders for the entire contract. The additional power will be used for the new traction lines, to be ready for operation soon, and for lighting purposes as well. A new line from Avalon to Emsworth has recently been completed, and work is to be started on the next division of the road down the Ohio river toward Beaver, which will run from Emsworth to Dixmont, passing around the rear of Sewickley. When that line is completed the distance between Pittsburg and Beaver will be nearly closed up with electric roads. These lines will be supplied with power from the central power station in Pittsburg. The new suburban line from Pittsburg to Canonsburg and Washington, Pa., will be completed this year and will demand more power, while the expansion of the city lines in many directions all call for additional power.

When the Brunot's Island power-house is fully equipped it will

be one of the largest of its kind in the world. There are some larger plants in hydraulic power in this and other countries. The first power-house of the Niagara Falls Power Company with hydraulic turbines contains only 50,000 h.p. capacity, and when built was the largest unit of horse-power known. Fuel for this plant will be obtained from a coal mine owned by the Pittsburg Railway Company adjacent to Brunot's Island, and which will give the company plenty of coal at practically the cost of mining. The fuel arrangements give the company quick handling of coal, and the ashes from the boiler are being used to fill up the low parts of the island, thus reclaiming them for commercial purposes. The total cost of this plant will be close to $2,000,000.

Trucks for the Hudson Companies.

The American Locomotive Company is preparing designs for 50 motor and 50 trailer trucks ordered by the Hudson Companies. The preliminary specifications from which the designs are being made were prepared by Mr. L. B. Stillwell, consulting engineer for the Hudson Companies, and the designs of these trucks will be made in consultation with him. Each motor truck will carry two General Electric Company's No. 76 motors. The motor suspensions will be of the nose type, and a motor will be geared to one wheel on each axle, the wheel hub being extended to take the gear for the motor. Both motor and trailer trucks will be of the bar frame swinging bolster type. The bolsters of rolled steel float between transoms of channel iron with freedom to move vertically, and are suspended by four 3-point (or stable equilibrium) hangers. The long 3-point hangers allow the bolsters a good lateral motion and utilize the weight on the trucks to restore the hangers to their proper position without the use of springs, thereby eliminating the pendulum motion of the car body so distressing to passengers and giving the car the same easy riding qualities as a Pullman coach. These trucks will be very similar in design to the trucks built by this company for the Schenectady Railway Company, which have been so satisfactory. The specifications for the trucks are as follows:

Motor Trucks.

Gage of track	4 ft. 8½ in.
Wheel base	6 " 6 "
Length over all	10 " 6½ "
Transverse center of frames	6 " 4 "
Load carried at center plate, total	28,000 lbs.
Weight of truck, without motor, about	10,500 "
Wheels	34¼ in.
Journal bearings	5x9½ "
Frames	Wrought iron
Transoms	10-in. channel iron
Bolsters	Rolled steel

Trailer Trucks.

Gage of track	4 ft. 8½ in.
Wheel base	5 " 6 "
Length over all	8 " 5 "
Transverse center of frames	6 " 4 "
Load carried at center plate, total	28,000 lbs.
Weight of truck	9,000 "
Wheels	30 in.
Journal bearings	4¼x9½ "
Frames	Wrought iron
Transoms	9-in. channel
Bolsters	Rolled steel

The Indiana Railroad Commission.

The Railroad Commission of Indiana was organized for business in May, 1905, and has been a valuable mediator between the shippers of the state and the railroads. One of the first complaints was one concerning a widespread shortage of cars, and the commission, by conciliatory mediation, adjusted amicably over 75 per. cent. of these complaints. It was found that non-competitive points were being neglected. The commission called upon the railroads to make an equitable distribution, and with but few exceptions the requests were complied with. Railroads were issuing bills of lading for grain endorsed "subject to delay"; the commission secured the abandonment of this objectionable feature. At Indianapolis the railroads were induced to reduce a switching charge of $4 to $3. Between Indianapolis and New Castle an important reduction of fares was secured. In southern Indiana the railroads were induced to make a reduction in the rates on coal from Indiana mines, thus giving these mines a traffic of 60 to 100 tons a day. This coal goes mostly to Jeffersonville, which had before been supplied by mines in Virginia and Pennsylvania. An order for a reduction of 15 cents a ton on coal transported over the Chicago, Indianapolis & Louisville was appealed and is now pending in the courts, as are also a number of other cases. The commission has spent much time considering interlocking signals at crossings.

Shippers say that the moral influence arising from the fact that there is a commission is alone worth many times the cost of the commission to the state. The cost is less than $20,000 a year. The President of the commission, Mr. Union B. Hunt, was formerly Secretary of State.—*Elkhart Review.*

A Crown Sheet Failure.

A dangerous leakage in a firebox, caused by an accumulation of scale on the top of the crown sheet, is the subject of the last accident report made to the British Board of Trade by Lieutenant Colonel Druitt. The accident occurred on the Lancashire & Yorkshire at The Oaks, April 19. The engine, which was nearly new, failed while drawing a passenger train, and the engineman was severely scalded. The crown sheet and a number of the staybolts holding it in place became so greatly overheated that the sheet bulged downward in the center, but there does not appear to have been any large rupture and there was no explosion, the pressure in the boiler having been gradually reduced as the staybolts gave way. Some of the hot water which fell on the engineman is believed to have been blown out through the tubes and up through the chimney.

The inquiry was made in conjunction with an inspector of the marine department of the Board of Trade, and the testimony of the men on the engine and the railroad inspectors, as well as the tests which were made by the Government inspectors, are reported at length, but the conclusion is, simply, that the crown sheet became overheated because of the accumulation of loose scale on its upper surface. This accumulation is charged to the carelessness of the men who last washed out the boiler. On the line where this engine is used boilers are washed out every eight days. The inspector does not say how much scale he found nor does he mention the thickness of the deposit. He found also on top of the crown sheet two pieces of lead fusible plugs which had been carelessly left there when plugs had been renewed. One of these pieces of lead, near the center of the sheet, was fused to the crown sheet, but the other, near the edge, was loose and was only partly melted.

The Hobson Wrench.

A new design of wrench combining the advantages of an "end" wrench for use on either pipe or nut is shown herewith. As indicated by the two views, the head may be placed in either of the two positions shown, to the further advantage and utility of the device. The end grip enables the wrench to be used on practically all kinds of machinery and in locations inaccessible to a side-grip wrench, as on a pipe lying against a flat surface. There are many points about a locomotive where the side-grip wrench cannot be used to advantage, but where it is claimed this wrench is especially effective. It consists of only three parts, while combining the functions of practically all wrenches. The handle is cast steel and the head and nut drop forged. It is made by the Hobson Wrench Co., Indianapolis, Ind.

The Hobson Wrench.

Panama Canal Bonds.

The $30,000,000 Panama Canal 2 per cent. bond issue was subscribed to several times over. Fisk & Robinson, New York, were awarded $15,000,000 at about 103.85; Samuel Byerly, New York, $5,879,000 at about 103.97; and $4,330,000 went to seven national banks at various prices.

Government Control in Japan.

The Japanese Government will take over six railroads, paying for them about $125,000,000. It will allow the companies 5 per cent. interest on the purchase price until the necessary bond issue is made; this need not be done, according to the laws, for five years after the date of purchase. The dates set for the taking over of the roads are as follows: the Hokkaido-Tanko and the Kobu Railroads, October 1; the Nippon and the Ganyetsu, November 1, 1906; the Nishinari and the Sanyo, December 1.

Disastrous Collision near Hamlet, N. C.

In a collision on the Seaboard Air Line last Sunday evening between Rockingham and Hamlet, N. C., 16 passengers and four trainmen were killed and 24 passengers and trainmen were injured. The collision was between eastbound passenger train No. 44 and a westbound freight. The baggage car and the second-class passenger car were demolished and eight freight cars were wrecked. It is said that the operator at Rockingham failed to deliver to the passenger train an order requiring it to wait for the freight.

Manufacturing and Business.

The Strangen-Wick Railway Company, which operates a suburban line near Stockholm, Sweden, has contracted with the Westinghouse Electric & Manufacturing Company for the electrical equipment of its cars.

The new buildings being erected by the Damascus Brake Beam Company at its Sharon, Pa., plant will be completed, and all addi-

tional machinery will be installed by August 15th. This addition will enable the company to double its present output of both "Damascus" and "Waycott" brake-beams.

H. F. Vogel & Co. is the name of a new general railroad supply house in St. Louis, with office at 420 Rialto Building. The firm is made up of H. F. Vogel and Nic LeGrand, both previously with the St. Louis Car Co., the former as Vice-President and General Manager, and the latter as Manager of the Supply Department.

The American Railway Steel Tie Co., 42 Broadway, New York City, reports an order from the Pennsylvania Railroad for 3,000 steel ties which are to be placed on the main line near Blairsville, Pa. These ties are made out of a pressed steel flared channel section filled with asphalt. The purpose of the asphalt, which rests directly on the ballast, is to give resiliency. The tie is the invention of Mr. J. G. Snyder, the Vice-President of the company. The Central Iron & Steel Co., of Harrisburg, holds a considerable stock interest.

Iron and Steel.

The Lehigh Valley has ordered 30,000 tons of rails from the Carnegie works of the United States Steel Corporation.

The Maryland Steel Co. has orders for 500 tons of rails for Chicago delivery, and also has orders for 160 tons of special girder rails.

The Chicago, Burlington & Quincy has ordered 10,000 tons of rails from the Carnegie Works for 1907 delivery. The Norfolk & Western and the Reading have each ordered, recently, 15,000 tons.

The New York, New Haven & Hartford has given an additional contract to the Pennsylvania Steel Co. for 4,000 tons of rails to be delivered in the fourth quarter of this year. Electric lines have given contracts for 5,000 tons additional for this year's delivery, and a number of the large steam roads are negotiating for 200,000 tons for 1907 delivery. The Vera Cruz Railway has bought 300,000 steel ties in Europe to be used in rebuilding its line from Mexico City to Vera Cruz. Inquiries are also being made for steel for bridge construction. In the Chicago market orders have been recently given for 1,500 tons of fabricated bridge material. Of these orders, the Pennsylvania Steel Co. secured 700 tons.

OBITUARY NOTICES.

R. M. Oberteuffer, Assistant to the President of the Philadelphia & Reading, died in Philadelphia on July 22.

C. J. Ives, formerly President of the Burlington, Cedar Rapids & Northern, died on July 18 at Woodstock, Vt., at the age of 75.

Edgar Shellabarger, Master Mechanic of the East Broad Top Railroad, died on July 12 at the age of 68. Mr. Shellabarger served in the Civil War and began railroad work in the Pennsylvania shops at Paterson, Pa. After spending several years in the Baldwin Locomotive Works, he went to the East Broadtop in 1882 as machine shop foreman. He was later appointed General Foreman and, finally, Master Mechanic.

Russell Sage died on July 22 at Lawrence, Long Island. Mr. Sage was nearly ninety years old, having been born in Oneida County, N. Y., in 1816. He was the last survivor of the original directors of the New York Central Railroad, having served on that board during the first six years of its existence. On January 1, 1906, he was President, Treasurer and Director of the Albia & Centerville; President and Director of the Poughkeepsie & Eastern; and Director of the Wabash, the Missouri Pacific, the Manhattan Railway Company, the Chattanooga Southern, the Iowa Central, the St. Louis, Iron Mountain & Southern, the St. Paul & Chicago, the Shore Line Railway of New Brunswick and the Texas & Pacific.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Birmingham Southern.—J. A. Topping has been elected President, succeeding J. G. Moore, resigned. S. A. Cameron has been appointed Auditor, succeeding R. W. Bidgood, resigned.

Chicago, Rock Island & Pacific.—H. M. Sloan, Auditor of Disbursements, has been appointed Assistant to the Fourth Vice-President. C. W. Balch succeeds Mr. Sloan.

Norfolk & Western.—H. C. Frick and L. C. Weir have been elected Directors, succeeding J. B. Taylor and W. H. Barnes, resigned.

Operating Officers.

Birmingham Southern.—F. H. Crockard has been appointed General Manager, succeeding J. G. Moore, resigned.

Chicago & Alton.—E. M. Stanton, formerly on the Chicago, Rock Island & Pacific, has been appointed Superintendent of Car Service.

Chicago & North-Western.—G. F. Bidwell, Manager of the Nebraska & Wyoming division, has been appointed General Manager of the Lines West of the Missouri river, with office at Omaha, Neb.

Chicago, Burlington & Quincy.—A. V. Brown, Superintendent at Hannibal, Mo., has been appointed Superintendent at Ottumwa, Iowa. Robert Rice, Assistant Superintendent at Ottumwa, succeeds Mr. Brown.

Cleveland, Cincinnati, Chicago & St. Louis.—D. F. Schaff, formerly Chief Clerk to the General Manager, has been appointed Superintendent at Indianapolis, Ind.

Missouri Pacific.—W. T. Caldwell has been appointed Superintendent of Terminals at Little Rock, Ark., succeeding H. L. Hungerford, transferred.

Southern.—The Augusta Southern will hereafter be operated as a separate division instead of as a part of the Charleston division. J. A. White, Assistant Superintendent at Alexandria, Va., has been appointed Superintendent of the new division, with office at Augusta, Ga.

Wabash.—G. M. Burns, Superintendent at Detroit, Mich., has resigned, to go into other business. J. J. Sim, trainmaster at Montpelier, Ohio, succeeds Mr. Burns.

Traffic Officers.

Birmingham Southern.—H. R. Moore has been appointed Traffic Manager, succeeding R. W. Bidgood, resigned.

Mexican Central.—J. C. McDonald, Assistant General Passenger Agent at Mexico City, has been appointed to the new office of General Passenger Agent, at that place, and the office of Assistant General Passenger Agent has been abolished.

Southern.—Brooks Morgan, Assistant General Passenger Agent at Atlanta, Ga., has resigned, to engage in other business. G. B. Allen, Assistant General Passenger Agent at St. Louis, Mo., succeeds Mr. Morgan. J. C. Beam, Jr., District Passenger Agent at Atlanta, succeeds Mr. Allen. H. F. Cary has been appointed to the new office of Assistant General Passenger Agent at Washington, D. C.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—R. D. Smith, Superintendent of Motive Power of the Lines West of the Missouri river, has resigned. Thomas Roope, Superintendent of Motive Power of the C., R. I. & P. at Topeka, Kan., succeeds Mr. Smith.

Chicago Great Western.—W. W. Chadbourn has been appointed Chief Engineer, with office at St. Paul, Minn., succeeding A. Munster, resigned. T. H. Bacon, Assistant Division Engineer at St. Paul, Minn., has been appointed Assistant Chief Engineer at that place.

Chicago, Rock Island & Pacific.—See Chicago, Burlington & Quincy.

Illinois, Iowa & Minnesota.—H. S. Rogers has been appointed Engineer of Maintenance of Way and Construction.

Lake Shore & Michigan Southern.—E. D. Bronner, Superintendent of Motive Power of the Michigan Central, has been appointed Superintendent of Motive Power of the L. S. & M. S., succeeding H. F. Ball, resigned, to engage in other business. S. K. Dickerson, Master Mechanic at Collinwood, Ohio, has been appointed Assistant Superintendent of Motive Power, succeeding L. G. Parrish, resigned to go to the Michigan Central. Joseph Chidley succeeds Mr. Dickerson. See Michigan Central.

Michigan Central.—L. G. Parrish, Assistant Superintendent of Motive Power of the Lake Shore & Michigan Southern, has been appointed Superintendent of Motive Power of the Michigan Central, succeeding E. D. Bronner, resigned to go to the L. S. & M. S. D. R. MacBain, Master Mechanic at Jackson, Mich., has been appointed to the new office of Assistant Superintendent of Motive Power. G. E. Parkes, Mechanical Engineer, succeeds Mr. MacBain. See Lake Shore & Michigan Southern.

Pennsylvania Lines West.—H. J. Shaw has been appointed Assistant Division Engineer at Toledo, Ohio, succeeding H. Eichler, resigned.

Southern.—P. S. Fitzgerald, Engineer of Maintenance of Way of the Western district, has resigned, to go into other business. F. M. Edwards, Resident Engineer at Chattanooga, Tenn., succeeds Mr. Fitzgerald, with office at Birmingham, Ala.

Purchasing Agents.

Birmingham Southern.—W. A. Major has been appointed Purchasing Agent.

LOCOMOTIVE BUILDING.

The Temiskaming & Northern Ontario has ordered two switching locomotives.

The Grand Trunk has ordered 20 passenger locomotives from the American Locomotive Co.

The Norfolk & Southern has ordered eight 10-wheel locomotives, two switching locomotives and seven 8-wheel locomotives from the Baldwin Locomotive Works.

The Missouri Pacific has ordered 35 six-wheel switching locomotives from the Baldwin Locomotive Works for October and November delivery. These engines will weigh 150,000 lbs.; cylinders, 20 in. by 26 in.; straight top boiler, with a working steam pressure of 180 lbs.; 274 tubes; total heating surface, 1,700 sq. ft.; firebox, 108 in. long by 42 in. wide; grate surface, 31.5 sq. ft.; tank capacity, 6,000 gallons; coal capacity, 8 tons. The special equipment will include: Railway Steel Spring Co.'s springs, Franklin boiler covering, Simplex injectors, Tower couplers, Westinghouse air-brakes, Ashcroft steam gages, Crosby safety valves, Nathan lubricators, Leach sanding devices and U. S. metallic piston and valve-rod packing.

The Pittsburg, Binghamton & Easton has ordered three simple 10-wheel locomotives from the American Locomotive Co. for September 1, 1906, delivery. These locomotives will weigh 168,000 lbs., with 130,000 lbs. on drivers. Cylinders, 21 in. by 26 in.; diameter of drivers, 62 in.; extended wagon-top boiler, with a working steam pressure of 190 lbs.; total heating surfaces, 3,000 sq. ft.; 342 Detroit cold-drawn seamless tubes, 2 in. in diameter by 16 ft. long; firebox, 98⅛ in. long by 65¼ in. wide; grate area, 44 sq. ft.; tank capacity, 7,500 gallons; coal capacity, 12 tons. The special equipment will include: Sectional Magnesia boiler lagging, Tower couplers, Dressel headlights, Nathan injectors, Jerome metallic piston and valve-rod packing, Leach pneumatic sanding devices, Detroit triplex sight-feed lubricators, Pittsburg Steel & Spring Co.'s springs, Midvale driving-wheel tires and cast steel wheel centers.

CAR BUILDING.

The Wisconsin Central, it is reported, has ordered a large number of ore cars.

The Denver & Rio Grande is reported as in the market for freight equipment.

The Chicago & Eastern Illinois has ordered six baggage cars from the Pullman Co.

The Tampa Northern has ordered 70 freight cars of 60,000 lbs. capacity from the Georgia Car Co.

The Central Ontario has ordered 10 Hart convertible cars of 80,000 lbs. capacity from Rhodes, Curry & Co.

The Temiskaming & Northern Ontario has ordered five cabooses and is in the market for four passenger cars.

The Duluth, Missabe & Northern, it is reported, is in the market for upwards of 1,500 steel ore cars of 100,000 lbs. capacity.

The Atchison, Topeka & Santa Fe, it is reported, is considering the purchase of 100 refrigerator cars as well as a large number of box cars.

The Philadelphia & Reading, it is reported, will build 25 cabooses at its Reading shops. They will be equipped with steel underframes.

The Atlantic Coast Line is in the market for from 400 to 500 box cars of 60,000 lbs. capacity and from 400 to 500 40-ft. flat cars of 60,000 lbs. capacity.

The Chihuahua & Pacific has ordered 30 box cars from the Mt. Vernon Car Manufacturing Co., in addition to the two cabooses reported in our issue of July 13.

The Florida East Coast has ordered 300 flat cars from the South Atlantic Car & Manufacturing Co. These are in addition to the 200 cars reported as ordered in our issue of July 13.

The Seaboard Air Line, as reported in our issue of July 6, has ordered 611 40-ft. flat cars from the American Car & Foundry Co. These cars will be 42 ft. 4 in. long by 9 ft. 6 in. wide, by 4 ft. 3 in. high, all outside dimensions. The bodies and underframes will be of wood. The special equipment will include: S. A. L. standard brake-beams, Westinghouse air-brakes, Tower couplers, Symington journal boxes and 33-in. cast iron wheels.

The Jersey & Hudson River Railway & Ferry Co. has ordered 43 closed cars from the J. G. Brill Co. for August and September, 1906, delivery. These cars will seat 44 persons, and will measure 43 ft. 6 in. long by 8 ft. 6 in. wide by 11 ft. 6¼ in. high, outside dimensions. The bodies and underframes will be of wood. The special equipment will include: built-up bolsters, Corning brake-shoes and Standard Rolled Steel Co.'s wheels.

The Intercolonial has ordered 200 hopper cars of 30,000 lbs. capacity from Rhodes, Curry & Co. These cars will weigh 20,700 lbs. and will measure 15 ft. 10½ in. long by 8 ft. 3 in. wide, inside measurements. The bodies and underframes will be of wood. The special equipment will include: Simplex brake-beams, Christy brake-shoes, Westinghouse air-brakes, Miner tandem draft rigging, Harrison dust guards, helical springs and cast iron wheels.

The Canadian Pacific has completed at its Angus shops 600 stock cars and 50 refrigerator cars, orders for which were placed last fall, and is building at its Angus shops 50 additional refrigerator cars of 60,000 lbs. capacity. These cars will measure 38 ft. 8 in. long over end sills and 9 ft. ½ in. wide over frame. The special equipment includes: Simplex bolsters and brake-beams, Westinghouse air-brakes, Tower couplers, Miner tandem draft rigging, Harrison dust guards, McCord journal boxes and Diamond pattern trucks.

The Lake Shore & Michigan Southern is building 49 baggage automobile cars at its Collinwood shops, and work will soon be begun on four for the Lake Erie & Western. These cars measure 58 ft. 2⅞ in. long by 9 ft. and ⅜ in. wide inside. The outside dimensions are 60 ft. long by 9 ft. 9⅝ in. wide. The height inside is 9 ft. 2⅛ in., and the over all height 14 ft. 2 in. from the rail. The bodies and underframes are of wood. They are equipped with double body bolsters, Diamond Special brake-beams, Westinghouse air-brakes, Tower couplers, Gould friction draft gear, Gold heating system, Lake Shore standard journal boxes, Safety Car Heating & Lighting Co.'s lighting system, Gould platforms, small end doors, and Davis wheels.

The Wabash has ordered 2,000 box cars from the American Car & Foundry Co. and 2,000 gondola cars from the Western Steel Car & Foundry Co. The box cars are of 80,000 lbs. capacity, and are for August and September, 1906, delivery. They will measure 41 ft. long by 9 ft. 1¼ in. wide by 14 ft. 5 in. high, outside measurements. The bodies and underframes will be of wood. The special equipment will include: American Steel Foundries bolsters, Damascus and Waycock brake-beams, Westinghouse air-brakes, St. Louis spiral brasses, Climax couplers, National door fastenings, Climax doors, Miner draft rigging and McCord journal boxes. The gondola cars are for October and December delivery. They will measure 41 ft. 5¾ in. by 9 ft. 9¾ in. wide by 8 ft. 9¾ in. high, outside measurements. The bodies will be of wood and the underframes of steel. The special equipment will include: Scullin-Gallagher bolsters, Western Steel Car & Foundry Co.'s brake-beams, Westinghouse air-brakes, St. Louis spiral brasses, Climax couplers, Miner, McCord and Fowler draft rigging and McCord journal boxes.

RAILROAD STRUCTURES.

Birmingham, Ala.—An officer writes that the Illinois Central, through its subsidiary line, the Alabama Western, is putting up freight terminals and a new freight house. The contract for the building has been let to the Leonard-Martin Construction Co., of Chicago. The company's forces are laying the track, which will aggregate about two miles.

Chattanooga, Tenn.—Bids for the Chattanooga Railway car shops were to be opened July 23. The shops will be 110 ft. x 200 ft., of brick, 1½ stories high, to cost about $50,000. D. J. Duncan is General Manager.

Cincinnati, Ohio.—The Cleveland, Cincinnati, Chicago & St. Louis has submitted plans and specifications for a new steel bridge to be built over its tracks on West Fifth street.

Cleveland, Ohio.—The Cleveland Short Line has given contracts to the American Bridge Co., New York, for building a steel viaduct over Cuyahoga Valley for $500,000, for the steel work only. The masonry will cost an additional $300,000.

New York, N. Y.—The New York City Railway Company will soon replace the old car stables at Twelfth avenue and 42d street, which were destroyed by fire several months ago. The new building is to be about 200 ft. by 200 ft., with facades of ornamental brick, and will cost $100,000.

Omaha, Neb.—Plans are being made in the office of the Chief Engineer of the Union Pacific Railroad at Omaha for new shop buildings and improvements in shop yards that will necessitate an expenditure of about $750,000 during the current year. These shops will consist of a series of buildings so arranged and of such size as will facilitate the handling of shop work in the most expeditious manner, and will enable the road to turn out its repair work without loss of time. The yards are situated on a level plat near the Missouri river a little north of the main part of the city of Omaha. For several years the company has been establishing shop facilities on this land, and already has completed and is using a model locomotive plant, blacksmith shop, offices and laboratory buildings. These new shops are to consist of two large buildings. The freight car and coach repair shop will be 492 ft. long facing to the south with one wing 342 ft. extending towards the north one story in height with steel framing and brick curtain wall construction. It will be fitted with cranes, machinery and modern conveniences for handling and repairing all classes of cars. Facing the building and

serving it and the paint, wheel and truck shop, which will be built directly north of the car shop proper, will be installed a transfer table 90 ft. x 350 ft. The paint, wheel and truck shop will be similar in general construction to the car shop building, but will be 302 ft. long by 178 ft. wide. It will be fitted with cranes and other apparatus for easy handling of wheels and trucks. Near this building, but separated from it, will be the paint storage house. Heavy cranes for service near the coach shops and for wrecked trucks will be set up in the yards, and there will be a wheel platform, depressed tracks and transfer table.

ROCHESTER, N. Y.—Plans have been filed by the Buffalo, Rochester & Pittsburg for a new freight house on the site of the present one on Oak street. The new building is to be 300 ft. long, 60 ft. wide and 26 ft. high. H. H. Edgerton has the contract for the masonry work, and Henry Rice for the wood work.

TULSA, IND. T.—The St. Louis & San Francisco has given a contract to Anderson & Brothers, of St. Louis, for putting up a new station here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICUS, SYLVESTER & SOUTHERN.—Application will shortly be made for a charter by a company under this name to build from Americus, Ga., on the Central of Georgia and the Seaboard Air Line southeast through the counties of Sumter, Lee, Worth, Colquitt and Berrien, to Hartpine, on the Georgia Southern & Florida. Rights of way have been secured for most of the distance. The names of the promoters are not given.

ATLANTIC, QUEBEC & WESTERN.—This company has been formed under special acts to build two railroads aggregating 362 miles. One line is to run from the deepwater harbor at Gaspe, Que., west, through Gaspe County to Amqui on the Intercolonial, thence south to Edmundston on the St. John river, 260 miles. At Edmundston connection can be made with the Canadian Pacific, and with the proposed Grand Trunk Pacific. The other line is to run from a point at or near Gaspe Harbor along the coast in a southerly direction through Douglas, Newport, Port Daniel, Hope and Cox to Paspebiac on the Atlantic & Lake Superior, 102 miles. The Provincial Government of Quebec has authorized the granting to the company of land amounting to 4,000 acres per mile for the 150 miles mentioned in the act. Bonds are now being offered in London to secure funds to carry out this project. Charles Brien and Joseph Lavoie, of Gaspe, are directors, and E. Stanley Elvey, Secretary.

CANADIAN NORTHERN.—Grading on the extension from Oakland, Man., to the Delta spur north of Portage la Prairie, has been commenced by James Cowan, who has the contract. Chief Engineer McLeod states that rails are to be laid at once between Ridgeway and Vassar.

CHICAGO, MILWAUKEE & ST. PAUL.—Local reports state that contracts for the Butte & Whitehall division of this road, which is building through Montana, have been let at about $3,000,000. At the present time there are more than 5,000 men at work on the line between Miles City, Mont., and Harlowton.

CINCINNATI, COLUMBUS & TOLEDO.—This company, with office at Cincinnati, has been incorporated in Ohio with $10,000 capital stock by R. C. Swing, H. J. Gibson, H. E. Frost, H. H. Huffman and C. D. Mathews. The company proposes to build a railroad from Cincinnati to Toledo.

DAKOTA MIDLAND.—An officer writes that this company, which was recently incorporated in South Dakota, will let contracts in September for building its proposed line from Sioux City northwest to a point in Campbell County, approximately 385 miles. The work will not be difficult though it includes two tunnels. L. R. Giddings is President, and J. A. Frederickson, Chief Engineer, both of 1341 Vine place, Minneapolis, Minn. (July 13, p. 10.)

DENVER & RIO GRANDE.—Announcement is made by this company that the present narrow gage line from Orange Junction, Colo., to Montrose, and the North Fork branch, from Delta to Somerset, will be changed at once from narrow gage to standard gage.

FRONT ROYAL, RAPAHANNOCK & TIDEWATER.—This Virginia company has completed its organization as follows: Colonel S. J. Millar is President; James H. Fletcher, First Vice-President; John J. Millar, Second Vice-President; H. H. Downing, Third Vice-President; E. H. Jackson, Fourth Vice-President; N. M. Johnson, Treasurer, and U. E. Naylor, Secretary. The office of the company is at Front Royal, Va.

GRAND TRUNK PACIFIC.—The Transcontinental Commissioners have called for bids for ties for the Winnipeg-Lake Superior section of the Grand Trunk Pacific. They want 275,000 ties delivered at St. Boniface, near Winnipeg, at dates from Aug. 31 to Nov. 15 of the present year. Bids are also asked for 200,000 ties to be delivered at later dates, at a point east of Winnipeg, where the Grand Trunk Pacific crosses the Canadian Pacific. Bids are also asked for 525,000 ties to be furnished at other places and times.

LAKE ERIE & PITTSBURG.—A contract is reported let by this company for a continuation of its line to Youngstown, Ohio. (See Construction Record.)

LANCASTER & NORTHERN.—Incorporated in Pennsylvania with $100,000 capital to build a line from a point on the Pennsylvania between Conestoga creek and the New Holland turnpike northwest to a point near Millway on the Philadelphia & Reading, about 10 miles. H. G. Seip is President. The directors are: R. W. Bowlby, A. Dufworth, F. Reeder, Jr., F. C. Rockafellow, W. Coil and A. Sausser, of Easton, Pa.

LIBERTY-WHITE.—It is reported that this company, which operates a line from McComb to Liberty, Miss., is to be extended northwest to Natchez, about 50 miles, crossing the Yazoo & Mississippi Valley near Roxie. An extension is now being built east from McComb to Columbia. It is supposed that the Illinois Central is back of the company. (See Construction Record.)

MALONE, FORT COVINGTON & HOPKINS POINT.—Incorporated in New York with $200,000 capital by W. F. Wright, of New York, and J. M. Cantwell and Lewis Mitchell, of Malone, to build a line from Malone in Franklin County north to a point in the Province of Quebec, about 18 miles. It is proposed to use gasolene cars.

NEW YORK, AUBURN & LANSING (ELECTRIC).—This company, incorporated in New York to build an electric line from Ithaca to Auburn, 34.6 miles, with five miles of siding, is selling bonds to secure funds to carry out the work. W. L. Fairchild, of New York, is Consulting Engineer. (See Construction Record.)

OHIO RIVER & WESTERN.—President S. L. Mooney is quoted as saying that this road, part of which is now 3 ft. gage, is to be made standard gage throughout.

OHIO ROADS (ELECTRIC).—George Ross, of Cleveland, is Chief Engineer of the company which is building an electric line from Lima via Kenton to Marion. The company, which has a capital of $100,000, is being promoted by J. W. Ogan, of Indianapolis.

OKLAHOMA CENTRAL.—Surveys for this line, it is said, have been completed to the proposed southern terminus at Paris, Tex., and track will be laid into Chickasha, the northern terminus, during the present year. Construction from Lehigh south will be under way in September.

OREGON ELECTRIC RAILWAY.—W. S. Barstow & Co., Inc., Engineers, report that plans are being considered for building several miles of extensions in connection with the Oregon Electric Railway Co., for whom Barstow & Co. are now building and equipping about 60 miles of road. Part of the main line between Portland and Salem, it is expected, will be put in operation September 1.

PENNSYLVANIA.—According to announcement made at Newcastle, Pa., this company has bought about 400 acres of land between Lawrence Junction and Moravia as a site for new yards. The tract is over three miles long.

PHILADELPHIA INTERURBAN LINE.—Work is to be begun next month on an electric line, from Pottstown to Paoli, to be built by this company, chartered under the laws of Pennsylvania some time ago. Right of way has been secured, and it is understood that the new line will reach 63d and Market streets, Philadelphia, over the tracks of the Philadelphia & Western. The line will run through Phoenixville, Linfield, Royersford and Valley Forge.

PORTLAND & SEATTLE.—James J. Hill is quoted as saying that this road may be extended to Spokane. Surveys are now being made, and if the grade is found to be easy the road will be extended to that place. It is proposed to work a part of the road by electricity. (See Construction Record.)

RALEIGH & SOUTHPORT.—This company, it is said, has begun to operate its extension from Lillington, N. C., south to Fayetteville, 30 miles, where connection will be made with the Atlantic Coast Line. (See Construction Record.)

ST. LOUIS & SAN FRANCISCO.—Surveys are reported made for a line from Joppa, Ill., the southern terminus of the Joppa branch of the Chicago & Eastern Illinois, south to Jackson, Tenn., as a connecting link between the Chicago & Eastern Illinois and the proposed northern terminus of the Mobile, Jackson & Kansas City at Jackson.

SAN PEDRO, LOS ANGELES & SALT LAKE.—Senator W. A. Clark is building a line from Las Vegas north to Bullfrog. The Senator denies the report that he has bought the Goldfield & Bullfrog, which is under construction. He says he is having an independent survey made. The engineers are now 31 miles out of Bullfrog. The road is to be built immediately from Bullfrog to Goldfield and Tonopah. It will connect with the San Pedro, Los Angeles & Salt Lake at Las Vegas.

Schoodic.—The state railroad commissioners have approved the location of the line of this Maine railroad. The proposed route is from the main line of the Bangor & Aroostook, 1½ miles north of Millinocket, Me., to Burntland Rips, on the Penobscot, west branch, below the mouth of the Schoodic, about 12 miles.

South & Western.—The Cumberland Corporation has recently issued bonds to complete the extension of this road to a connection with the Seaboard Air Line at Rutherfordton, N. C. When finished to Rutherfordton the South & Western will be 107 miles long.

South Bethlehem & Saucon (Electric).—Incorporated in Pennsylvania with $42,000 capital to build a line seven miles long, from South Bethlehem to Centre Valley, where connection is to be made with the Philadelphia line of the Lehigh Valley Transit Company. The stockholders are C. P. Hoffman and William H. Lauer, of South Bethlehem; U. H. Wieand, of Emaus, and Hugh E. Crilly, P. F. Cannon and T. H. Mulligan, of Allentown. With the completion of this line the North Penn Railroad will be paralleled every foot of its way by trolley roads.

Thomasville & Gulf.—Residents of Thomasville, Ga., in connection with C. R. Knight, formerly of the Atlantic Coast Line, are having surveys made for a line from that place, which is on the Atlantic Coast Line and the Atlanta, Birmingham & Atlantic, southwest to a junction with the Apalachicola Northern, about 50 miles. The Apalachicola Northern is building from St. Joseph on the Gulf of Mexico northward to Apalachicola and River Junction on the Atlantic Coast Line, the Louisville & Nashville and the Seaboard Air Line.

Versailles & Sedalia.—Incorporated in Missouri with $50,000 capital to build a railroad in that state. The line, six miles long, is to connect the Chicago, Rock Island & Pacific and the Missouri Pacific with the coal fields which are being developed by the Missouri Cannel Coal Co. James Applewhite is President; W. W. Farris, Vice-President; G. R. Able, Vice-President and General Manager; J. C. Ottinger, Treasurer, and S. W. Tate, Secretary, all of Memphis, Tenn., excepting Vice-President Able.

Youngstown & Southern.—A contract has been let to J. G. White & Co., of New York City, as engineers for the electrification of this road operating between Youngstown and Columbiana, O., 16 miles. This road was built by J. G. White & Co. several years ago. The Youngstown & Southern is now engaged in extending this line to Leetonia, an additional five miles, and this extension will also be electrified by J. G. White & Co. The contract covers the necessary rolling stock, transmission, overhead, sub-stations, etc. (See Construction Record.) The road is to be eventually extended south to East Liverpool, 30 miles from Leetonia, and will provide through service from East Liverpool to Youngstown and from Canton, Akron, Alliance and Salem to Youngstown. J. G. White & Co. will actively push this work, and expect to have it completed late this summer.

RAILROAD CORPORATION NEWS.

Boise, Nampa & Owhyee.—See Idaho Northern.

Boston & Maine.—Stockholders have been given the right to subscribe, up to August 15, 1906, to an issue of $5,331,900 of common stock, 42,037 shares of which were recently authorized, the remainder being stock already held in the company's treasury. Stockholders are to have the right to subscribe for the new stock at 165 at the rate of one share for every five shares already held. Payment can be made in full, in which case the stock is entitled to the next dividend, or it can be paid for in four equal instalments up to December 31, 1907, the stock in this case participating in the dividend distribution in proportion to the amount paid up.

Brooklyn Rapid Transit.—During the fiscal year ending June 30, 1906, this company carried 452,604,203 passengers, an increase of about 16 per cent. The car mileage increased only about 10½ per cent., the average car load having increased from 6.76 passengers to 7.12 passengers.

Canadian Northern Ontario Railway.—See James Bay Railway.

Canadian Pacific.—This company has redeemed the last of its $15,000,000 3½ per cent. land grant bonds. These bonds were secured on the unsold lands granted to the company, and the Dominion Government guaranteed the interest for 50 years. The railroad company has been turning over to the government proceeds from the sales of its lands, forming a sinking fund for the redemption of the bonds. Of the 28,425,000 acres originally granted, the company now has about 11,000,000 acres unsold; this property is estimated to be worth about $150,000,000.

Cumberland Corporation.—This company owns the stock of the Clinchfield Coal Company, the stock of the South & Western Railroad and part of the stock of the Seaboard Company, the last named company being a holding company organized a year ago in connection with the reorganization of the Seaboard Air Line. The Cumberland Corporation has $25,000,000 common stock, $15,000,000 6 per cent. preferred stock, and has sold $15,000,000 6 year 5 per cent. notes to Blair & Co., Speyer & Co., and the Old Colony Trust Company. The proceeds of the sale of the notes will be used to complete the South & Western.

Delaware & Hudson.—See Hudson Valley.

Hudson Valley.—This company was recently reorganized, and among the new securities created were $2,500,000 2 per cent. debenture B bonds which, after two years, can be exchanged at par for 5 per cent. preferred stock. E. Clarence Jones & Co., and C. W. Morse have been, supposedly, in control and are said to have bought a large amount of the debenture bonds at about 30. The Delaware & Hudson, which also owns stock, is now suing the above named interests to prevent the exchange of the bonds for the preferred stock on the ground that, under the New York State law, preferred stock cannot be issued at less than par and, if the proposed arrangements are carried out, it will amount to the debenture bond holders getting preferred stock at a cost of only about $30 a share.

Idaho Northern.—This company has taken over the Boise, Nampa & Owhyee, which runs from Nampa, Idaho, to Murphy, 30 miles.

James Bay Railway.—The name of this company has been changed to the Canadian Northern Ontario Railway.

Kansas City, Mexico & Orient.—The President has gone to Europe to sell $15,000,000 bonds. There are at present outstanding $5,242,000 first mortgage 4 per cent. bonds of 1951, and these, together with equipment trust certificates and certain obligations of the K. C., M. & O. subsidiary construction companies, make the total outstanding debt at present between $7,000,000 and $10,000,000. The first mortgage bonds are issuable at the rate of $22,500 per mile of single main track; $15,000 per mile of yard and terminal track, and $12,000 per mile of double track built or acquired. The mortgage also provides for the issue of $17,500,000 for the very expensive construction through the Sierra Madre Mountains, for terminal facilities and for future requirements and additional rolling stock.

Nashville Railway & Light.—The stockholders have authorized the issue of $15,000,000 refunding mortgage 5 per cent. bonds. The company owns all the street railroads of Nashville, amounting to about 72 miles of line, and also has lighting properties. Of the new bonds, $7,500,000 will be sold immediately; $6,000,000 for the retirement of all the present outstanding bonds, and the remainder for improvements and extensions.

Pittsburg & Lake Erie.—See Wabash-Pittsburg Terminal.

Seaboard Air Line.—See Cumberland Corporation.

South & Western.—See Cumberland Corporation.

Underground Electric of London.—A call of 25 per cent. per share (par value $48.50) has been made upon the holders of the about $24,250,000 outstanding common stock, which is 50 per cent. paid up. The call is payable in two equal instalments, August 15 and September 13, 1906.

Union Pacific.—The gross earnings of this company during the month of May, 1906, were $5,666,931, an increase of $950,061.

United Railways & Electric Company of Baltimore.—A plan of reorganization of the finances of this company has been approved by the Board of Directors and the income bondholders' committee. The plan provides for the issue of $14,000,000 5 per cent. 30-year bonds, of which $1,400,000 will be issued at once to be exchanged at face value for the coupons representing five semi-annual instalments of interest in default on the $14,000,000 4 per cent. income bonds. The plan also provides for the consolidation of the Baltimore & Annapolis Short Line with the new Maryland Electric. The B. & A. S. L. is a steam line running from Cliffords, Md., to Annapolis, 22 miles, and has no funded debt. This line will be electrified, and the consolidated company will make a mortgage securing $8,000,000 5 per cent. 25-year bonds, of which about $4,000,000 will be issued soon to provide for the acquisition of terminal stations, car barns, and extensions, which will belong to the consolidated company but will be leased to the United Railways & Electric.

Wabash-Pittsburg Terminal.—This company has made an agreement with the Pittsburg & Lake Erie, according to the terms of which the P. & L. E. gets some of the Wabash terminal property in Pittsburg on the south side of the Monongahela river, east of the W.-P. T. bridge into the city of Pittsburg proper. The P. & L. E. will build freight terminal facilities on the property. In exchange, the W.-P. T. gets trackage rights over the P. & L. E. enabling it to reach this hitherto undeveloped terminal property.